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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. DECEMBER 28, 1899. CHICAGO, ILL. NUMBER 52

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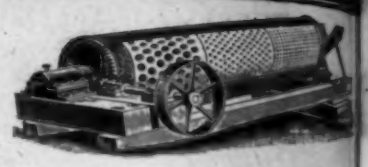
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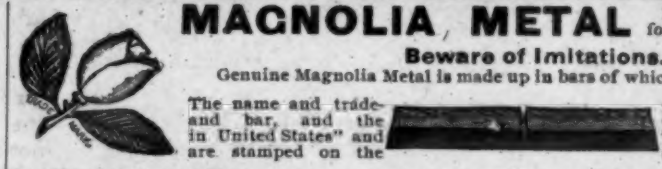
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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. DECEMBER 28, 1899. CHICAGO, ILL. NUMBER 52

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The closing week of the year is of no significance for what it has actually brought forth in market transactions. All interest in the iron trade centers in the months immediately ahead. The crash in Wall Street values is looked at more calmly now that the worst seems to be over, but the extent to which industry will be affected ultimately is still only a matter of conjecture. Dearer money has come by the operation of the same law that has pushed up prices of iron and steel. How far the advance in the price of loans will limit enterprise is a question the iron trade would gladly be able to answer as it faces the new year. If money seeks sound investment channels rather than speculation, as the result of the stock market panic, the business world may yet be the gainer. The foreign monetary situation for the moment puts an interrogation before the world-wide expansion of industry that has been so notable a development of the year, but this, too, is a factor concerning which assurance may not be long delayed. Looking forward to the active season of 1900, one feature that may assume importance is that relating to labor. As in the present year, some large producers of iron and steel, whose schedules are fixed for a twelve-month, will go on undisturbed; but there are indications in other directions that issues will be raised on which there will be decided differences between employers and employed. Labor questions at lake docks are vitally related to the iron trade, and they are far from being stably settled. Foundry labor has assumed an attitude on some questions apart from wages that may bring serious interruptions to that important consuming interest. However, the iron trade is not crossing bridges until they are reached. So far as immediate conditions are concerned they are highly favorable. That the quietness of December has not affected pig iron values is a proof of the inherent strength of the situation. So heavily sold are producers to the middle of the new year that there is no inducement to make concessions for the sake of getting business now. As a rule shipments are behind contract stipulations, and the contingency that might cause a weakening of prices in the next few months is not any possible increase in production but some serious interference with consumption, such as labor troubles. The increase in capacity to produce castings has been noticeable in the past six months, and indicates that producers see avenues for permanent enlargement of their trade. In some quarters, in consequence, the view has been entertained that a foundry demand sufficient to carry prices even higher, may be realized in the first half of the new year. There are no developments in Bessemer pig iron or Bessemer steel. The bulk of the sheet bar contracts of individual producers are yet to be made for the first half. Buyers are chary of taking hold at $36 to $38, but prices show no indication of yielding. In finished lines the month of December has produced more business than might have been expected under yielding prices in plates and sheets Bars have held firmly, and consumers of structural material are well satisfied in view of the decision of manufacturers to leave prices unchanged for the present. The situation in all lines is such that a buying movement early in the year might easily bring firmer and advancing prices.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
705 PUBLICATION BUILDING, Dec. 27.

The past week has been very dull, but the dullness serves rather to indicate the strong position of producers than to indicate any weakness in conditions. Buyers show no inclination to take hold, but sellers are perfectly satisfied to let them bide their time and on all hands confidence is expressed that prices will be higher when the new year is a month or two old. Quotations in many lines are largely nominal, there not having been sufficient transactions in the week to absolutely fix values, but the business which has been done does not show any change toward higher or lower figures.

There are two very important elements of strength in the situation at the present time. The first is that large producers generally have a big tonnage on their books for next year, and cannot afford to allow anything to occur which would tend to unsettle affairs, hence prices are strongly held and business is let go if necessary. The second is that there are practically no producers who are in the position of needing cash badly. Heretofore in dull times low prices have been brought about mainly by producers here and there requiring cash, to secure which they had to sacrifice some of their output, which unsettled the market. Now sellers are not found in such a position.

Business is going to be very good for contractors and machinery builders in the whole range of iron and steel construction. Besides the many new steel foundries, machine shops, etc., which are being built, the newly formed iron and steel consolidations are going to spend large sums of money in betterments, enlargements, and concentration of plants. In many cases the removals will involve the expenditure of nearly as much money as would the erection of a new plant.

PIG IRON.—The market has been very dull, with scarcely enough transactions to show that prices have been maintained. In Bessemer, sales have been confined to small lots for nearby delivery, for which about $25, Pittsurbg, is secured. The price for the first half of next year is held firmly at $24, Valley, but there is very little available tonnage. It is doubtful if a lower rate could be secured for third quarter iron. In foundry and forge iron prices are as last quoted:

Bessemer, valley furnace	$24.00	to	$24.25
Bessemer, Pittsburg	25.00	to	25.25
No. 1 Foundry	23.75	to	24.00
No. 2 Foundry	23.00	to	23.25
No. 3 Foundry	22.25	to	22.50
Gray Forge, valley furnace	21.00	to	21.25
Gray Forge, Pittsburg	21.00	to	21.50

STEEL.—The steel billet market has been very quiet, and little is doing or in prospect in the near future. There has been a fair tonnage of steel billets sold for next year, so that, taking into account the rails sold for 1900 delivery, and the rail orders held over, the mills are pretty well fixed for a while. In sheet bars the mills are manifesting a little more interest than they were, but are not yet disposed to take hold to any extent. We quote Bessemer billets at $35 to $36 and sheet bars at $36 to $37. Open-hearth billets are held at from $42 to $45.

FERRO-MANGANESE.—An advance from $100 to $125 has just been announced in the price of 80 per cent domestic ferro in large lots.

RAILS AND TRACK MATERIAL.—There has been no change of

note in the situation. Both rails and track material are being sold in fair volume. We quote: Rails, standard sections, over 200 tons, $35; 100 to 200 tons, $37; car lots, $38; less than car lots, $40; light rails, 25-pound, and less than 50-pound, $37, all f. o. b. mill, Pittsburg; track material—Spikes, 2.50c; track bolts, square heads, 3.60c; hexagon heads, 3.85c; splice bars 2.50c to 2.60c; links and pins, 3c to 10c.

BARS.—Makers are holding quite strictly to formerly quoted prices on bars, and the market is quiet. While there is considerable tonnage booked for next year, the quantity is not as large as there was reason to expect from the standpoint of a couple of months ago. We quote steel bars at 2.25c, base full half extras, common iron bars at 2.15c, valley, and refined iron bars 2.40c, Pittsburg.

STRUCTURAL MATERIAL.—There is no change to be noted in the structural market, which is comparatively quiet. We quote prices unchanged as follows: Beams and channels, 3 to 15 inches, 2.25c; 18 to 24 inches, 2.35c; tees 2.30c; zees, 2.25c; angles, 2.25c. Universal mill plates, 2.50c to 2.75c, according to delivery and size of order. The manufacturers at their recent meeting voted to continue the present arrangement for another year.

PIPES AND TUBES.—Practically all the mills are shut down this week, and orders are being filled from stocks, which will be sufficient to tide over until the beginning of the new year. The mills are not disposed to sell their product far ahead, except as it goes into actual consumption. We quote prices unchanged as last quoted: Merchant pipe, 50 and two 10's for car-loads delivered within the specified territory; well casing, screw and socket joint, 37½; inserted joint, 32½, with an optional 5 per cent to dealers only; boiler tubes 1¼-inch to 1½-inch, 40 per cent off; 1¾-inch to 2½-inch, 50 per cent off for iron, and 55 per cent off for steel; 2¾-inch and larger, 52½ per cent off for iron and 55 per cent off for steel, with 5 per cent additional in carloads, less than carloads being f. o. b. mill.

PLATES.—There has come to be a distinction made in quotations for nearby or extended deliveries. For tank plate, assorted widths, for delivery during the first half of next year, we quote 2.50c, while for early delivery a price of 2.40c might be secured, while in either case for narrow plates the figures given could be shaded materially. The market is decidedly quiet. We quote: Shell steel, 2.60c to 2.70c; flange 2.70c to 2.80c; and fire box 3¼c to 4c.

SHEETS.—The sheet market is still very dull and there is little disposition to take hold. It is positively asserted that current prices do not cover the present cost of labor and raw materials, but buyers have been so frightened by the drop which has occurred that they are unwilling to enter into contracts, so that it is a difficult matter to sell sheets to close out the lots of bars which the mills have at present prices. We quote the market at 2.95c to 3c for No 28 common. Galvanized sheets are unchanged at 75 and 5 to 75 and 10 per cent off with a 15-cent freight allowance.

SPELTER.—The spelter market is dull and unchanged in price at 4.70c, Pittsburg, for prime Western grades.

OLD MATERIAL.—All lines of old material, as well as new melting stock, continue quite scarce, and this has served to maintain prices quite well, so that we have no change to note this week, and quote prices as follows, although these are largely nominal on account of the absence of transactions: Pittsburg, gross tons, except where otherwise specified: New Bessemer melting stock, $26 to $27; basic open-hearth scrap, $28 to $30; steel rails, mixed lengths, $22 to $23; short lengths, $23 to $24; iron rails, $29 to $31; cast borings, $14 to $15, net tons; cast scrap, $18 to $20; No. 1 wrought scrap, $24 to $25, net tons; busheling scrap, $16 to $18, net tons.

COKE.—Production has been well maintained this month at a rate which previous to the recent past has never been known in the Connellsville region, but transactions are not numerous. We quote stric ly Connellsville furnace coke at $2 75 to $3 and foundry at $3 25 to $3.50.

CHICAGO.

Office of The Iron Trade Review,
1522 MONADNOCK BLOCK, Dec. 27.

Conditions have changed very little in the past week. The demand for most classes of material has not been large, and sales have been limited to only small lots. Mill and furnace representatives are still looking forward to a good month's business in January, and judging from the inquiries in hand the chances for a realization of their expectations are excellent.

PIG IRON.—Only a small business was done last week. Shipments on contracts are going ahead very rapidly, but some complaint is still heard that furnaces are not keeping up with their orders. Foundries continue to run full time, and would undoubtedly use more iron if the furnaces could get it to them. The demand for iron for next year is large, and furnaces are expecting a good tonnage to be closed soon after the first of the year. Dealers are very firm in their views, and are asking and getting an advance on iron for immediate delivery. Quotations are unchanged:

Lake Sup. Charcoal	$25 50 @ $26 50	Southern Coke No. 3	$21 00 @ $22 00
Local Coke Fdy. No. 1	25 00 @ 25 50	Southern No. 1 Soft	23 00 @ 24 00
Local Coke Fdy. No. 2	24 50 @ 25 00	Southern No. 2 Soft	22 00 @ 23 00
Local Coke Fdy. No. 3	24 00 @ 24 50	Southern Silveries	26 50 @ 27 00
Local Scotch Fdy. No. 1	25 00 @ 25 50	Jackson Co. Silveries	32 00 @ 32 50
Local Scotch Fdy. No. 2	24 50 @ 25 00	Ohio Strong Softeners	24 50 @ 25 00
Local Scotch Fdy. No. 3	24 00 @ 24 50	Alabama Car Wheel	24 00 @ 26 00
Southern Coke No. 1	23 00 @ 24 00	Malleable Bessemer	24 00 @ 25 00
Southern Coke No. 2	22 00 @ 23 00	Coke Bessemer	25 00 @ 26 00

BARS.—No large inquiries for immediate purchase have been received in the week. The demand is expected to increase largely in January. Quotations are maintanied at 2.35c to 2.50c for both iron and steel, half extras, Chicago delivery.

STRUCTURAL MATERIAL.—No large contracts were closed last week, and it is not likely much will be done for a few weeks to come. There is a large tonnage of business in sight for next spring, however. Several large manufacturing concerns are contemplating improvements and additions which will take a considerable tonnage of material. Quotations follow: Beams, 15 inches and under, 2.40c; 18 inches and over, 2.50c; angles under three inches and over six inches, 2.50c; three inches to six inches, 2.40c; sheared plates, 2.90c to 3.15c; universal plates, 2.80c to 3c; tees, 2.45c; zees, 2.40c; small lots from store are quoted from ¼c to ½c higher.

PLATES.—There is no change in the situation. The demand was not heavy last week, and was confined almost entirely to small lots for store shipment. We quote tank steel from store, 3.20c to 3.40c. Mill shipments, Chicago delivery: Tank steel, 2.90c; shell, 3.10c; flange, 3.15c; marine 3.30c; fire box, 4c to 6c, according to brand.

MERCHANT STEEL.—Mills are making large deliveries on old contracts, but local dealers report only a comparatively small business closed or in sight for the immediate future. The demand is expected to increase materially after the first of the year. Smooth finish tire steel is quoted 2.80c to 3c; smooth finish machinery steel, 2.95c to 3.05c; spring steel, 3.65c to 3.75c; tool steel, 7c to 7.50c; special, 13.50c and upwards.

MERCHANT PIPE.—The market is quiet, with only small sales closed last week, and nothing large in sight at present. Prices are unchanged at 50 and two 10's off for mill shipment on large orders, and 50 and 10 and 5 off on small orders.

SHEETS.—Several quite good-sized contracts were taken in the week, and others are expected to be closed within a short time. The market is firm, and quotations are maintained at 3c to 3.20c for No. 27 black sheets, Chicago, and 70 and 10 for galvanized.

BILLETS AND RODS.—Some small business has been placed in this market with outside mills, but the local mills report no sales last week. The market is about $37 for Bessemer billets, and $45 for open hearth. There are no quotations on rods.

RAILS AND TRACK SUPPLIES.—There are a few good orders in sight, but it is not likely they will be placed until after the first of the year. Quotations are as follows: Rails, standard sections, $35 to $38; light sections, $37 to $42; splice bars, 2.50c to 2 70c; spikes, 2.75c to 2.85c; track bolts, 3.65c to 3.85c.

WIRE AND WIRE NAILS.—The holiday quiet is noticeable and business is not expected to increase until after the first two or three weeks in the new year, as jobbers are all busy taking stock at this season. Quotations are unchanged. Makers quote single carloads of wire nails at $3.25 f. o. b. Chicago, and $3.35 for less than carloads. On wire, current quotations are as follows: Plain annealed wire, $3.10; painted barb wire, $3.70; galvanized barb wire, $3.85.

OLD MATERIAL.—The demand is light, and sales last week were not especially large, except in one or two instances in

which round lots were disposed of. Dealers are strong in their views and are not disposed to make concessions. Their quoted prices follow:

Old iron rails, gross,	$26 00@$27 00	Country malleable	$15 00@$16 00
Old steel rails, long, gr.	24 50@ 25 50	Iron axles, net	28 00@29 00
Old steel rails, mixed	20 50@ 21 50	Cast borings, net	10 00@11 00
Relaying rails, gross	30 00@ 31 00	Wrought turnings, net	11 00@12 00
Old wheels, gross	22 50	Iron axle turnings, net	13 00@14 00
Railroad forge, net	25 00@ 26 00	Steel axle turnings	12 00@12 50
Dealer's forge, net	16 50@ 17 00	Mixed country steel, gr	15 00
No. 1 cut mill, net	14 00@ 15 00	Stove plates, net	10 00@10 50
Heavy cast, net	14 50@ 15 00	Heavy melting steel, gr	19 00@20 00
Railway malleable, net	16 00	Old iron splice b., net	27 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
27 VINCENT ST., Dec. 27.

Later than in any year of its history the Lake Superior iron ore movement has come to an end for 1899. It is worthy of record that some vessels are still unloading at Lake Erie docks and it is probable that their cargoes will not be out of them before the new year. The question of wages for loading ore from the docks into cars has been settled in the past week, and furnace companies will be so far relieved of the anxieties that have attended the operations of some of them in the past few weeks, though the car supply is not yet what they would have it.

Official statistics of the water shipments of ore from upper lake docks in the past season are now made up, as detailed elsewhere, and give a total of 17,901,358 gross tons. This indicates that when all-rail shipments are added—and these have been larger than for several years—the total for the year will be in the neighborhood of 18,500,000, or nearly 4,500,000 tons beyond last year's record The unusual experience of this year is crowding the making of contracts and other details of the sale of millions of tons of ore for 1900 into the closing days of the year along with the winding up of the business of an extraordinary year in ore. The period of quiet that will follow, for the ore sales offices, will be long drawn out.

PIG IRON.—Sellers of foundry iron have had little to do in the past week, but their calculations for 1900 are based on an increase in foundry capacity that has been made in the past six months in response to the rapidly growing demand for castings. So large a part of the production of every kind of iron in the first half of 1900 is sold, that there is little discussion of a change in prices in the next few months, unless it be that the demand of the opening season should cause an advance on early deliveries. Now and then an odd lot of No. 3 or No. 4 or of forge iron as it is worked off in connection with other sales goes at less than the top figure for that grade of iron; but on standard grades there is no change. In Bessemer iron there is nothing doing and no change is looked for. The two new furnaces at Youngstown that will start early in the year and the new Laughlin furnace at Pittsburg will be needed, it would seem, to prevent a shortage in the supply of Bessemer metal. We continue quotations as last given:

Bessemer	$24 90	Valley Scotch No. 1	$23 00@23 50
No. 1 Strong Foundry	23 00@ 23 50	Valley Scotch No. 2	22 50@23 50
No. 2 Strong Foundry	22 50@ 23 00	Gray Forge, valley	21 00@21 25
No. 3 Foundry	21 50@ 22 00	Lake Superior Charcoal	25 00@26 00

FINISHED MATERIAL.—It has been probably the dullest week of the year for mill products, as was to be expected. But the fact that holiday shut-downs have been limited to a single day in some instances and much less than the usual repair time in others, indicates that consumers are urgently pressing for the material due them. The weakness in plates has gone far enough to bring them close to their normal relation to other products. Ship plates bought at Toledo the past week, bids on which were referred to in our last report, are reported to have been on a 2.40c basis, Toledo. There is a 14-cent freight from Pittsburg. In other instances where small lots are involved, bids are reported on a Pittsburg basis of 2.40c for tank, 2.50c for shell, and 2.55c for flange. A further purchase of plates and shapes for a vessel of like capacity to that to be built at Toledo is expected. In sheets, where any desirable tonnage is gone after, the eagerness of mills for business crops out; and this condition may be expected during the winter months. We quote 2.85c to 2.90c, Pittsburg mill, for No. 27 black, and 75 and 10 to 75 and 5 per cent discount on galvanized. Little business is reported in structural material or in bars. Prices on shapes were left unchanged by the recent meeting of producers—2.25c, Pittsburg, for beams and channels up to 15 inches. We quote bar iron at 2 15c in carload lots, valley mill, and steel bars at 2.25c, Pittsburg. There is little doing in wrought pipe, but considerable work is planned for the open season.

OLD MATERIAL.—Prices are nominal and the market is quieter than for weeks, with prices of some varieties rather easier. We quote No. 1 railroad wrought scrap at $24, delivered; machinery cast scrap, $17; busheling scrap, $16; iron rails, $28 to $30 in the valley; wrought turnings, 14; cast borings, $12 to $13.

WIRE AND WIRE NAILS.—The demand upon mills is not large, but there is a steady movement from jobbers' ware houses, with here and there some uneveness in the quotations of the latter. Mills are now in the season when they accumulate stocks for the spring trade. We quote wire nails at $3.10, Pittsburg mill, in carload lots to retailers, and $2.95 in carload lots to jobbers; smooth wire, $2.80 in carload lots to jobbers and $2.95 to retailers; barb wire, $3.40 for painted, and $3 55 for galvanized to jobbers, with 15c advance to retailers.

CINCINNATI.

Dec. 26.

Rogers, Brown & Co. say: "The business of the week has aggregated a larger tonnage than there was reason to expect. Some fair sized orders for Bessemer and malleable irons have been booked for extended future deliveries at full market prices current. Hurry orders for small lots have been numerous, and the car lot trade has been quite active. There have been more new foundries started the past three months than in any quarter since 1892. One large concern having a very extensive foundry of its own, informs us that they were unable to take on some new business offered, as they could not find a foundry to make castings for them. This fact gives additional proof that the foundry capacity of the Central States is fully taken up.

"The increased income of the wage earners in the iron and steel industries, and of those engaged in mining and handling the raw materials entering into the manufacture of iron, including the machinists, molders, mechanics and laborers, aggregate many millions of dollars per month. Their prosperity is shown in the extraordinary indulgence in liberal Christmas buying. The "Holiday week" will prove a holiday fortnight this year. The stability of the business interests of the country was well proven the early part of the week in the tremendous financial scare in Wall Street, producing no effect whatever upon the trade, beyond temporarily depressing the securities of the iron and steel companies. The shrinkage in value of $100,000 000 in only 40 corporations, between Saturday night and Monday afternoon, scarcely ruffled the surface of the great ocean of traffic. The coke situation has given many foundrymen great inconvenience; inadequate railway rolling stock is as much the cause of the trouble as the scarcity of the coke. The market is firm."

We quote for cash f. o. b. Cincinnati: Southern coke No. 1 foundry, $21.75 to $22.25; Southern coke No. 2 foundry, $20.75 to $21.25; No. 3 foundry, $19.75 to $20.25; No. 4 and gray forge, $19.25 to $19.75; No. 1 soft, $21.75 to $22.25; No. 2 soft, $20.75 to $21.25; Lake Superior coke, No. 1, $24 to $24.50; No. 2, $23.50 to $24; Hanging Rock charcoal, No. 1, $25 to $26; Jackson county silvery, No. 1, $30 to $31; standard Georgia car wheel, $24.75 to $26.25; Lake Superior charcoal, $25.50 to $26.50.

PHILADELPHIA.

Dec. 26.

The fact that there is plenty of business to be had at the inside quotations for pig iron, and that these are as a rule only made on odd lots not of standard brands, indicates how substantial is the present basis. The inability of the furnaces to make any accumulation of iron is still a foremost feature, and until the margin becomes pronounced on that side, the prospects of even a slight recession in prices are not promising. There are efforts by buyers to draw out better than current quotations in response to offers going $1 or more below the generally accepted market, but nothing comes of these. It is exceptional to find a furnace able to make prompt shipment, except for small lots. There are no influences surrounding the market that point to any early change in prices; what may ultimately come from recent financial

disturbances in New York or from conditions abroad is of course a matter of conjecture. At present no trace of these influences can be found in the prices of iron and steel. We continue to quote No. 1 foundry, standard brands, at $25 to $25.50; No. 2X foundry, $23.25 to $24.25; No. 2 plain, $22.25 to $22.75; gray forge, $20.50 to $21. In the semi finished material the market continues quiet. Bids of $30.50 at maker's mill are made, but $31 is still asked. Billet manufacturers are asking $37 and $38, but buyers will not take hold, arguing that this basis is out of relation to present prices on finished material. The only sales are in small lots for special uses. There is quite a good demand for rolled material, but prices are below the November and early December basis. The mills have secured work that will run them into February and March and the prospects are that prices will now be better maintained. There has been considerable competition on plates between Eastern and Western mills. The prospect of increased demand after the new year is fairly started is expected to bring recovery of what has been lost, though the extremes, as in the case of plates, may not be repeated. We quote tank plates at 2.50c; beams, channels and tees, 2.40c to 2.60c; No. 27 sheets, 3.10c; refined bar iron, 2.10c to 2.20c. The market for old material can scarcely be quoted. Tracks at Central Pennsylvania and Lebanon valley mill points have been full of cars for the past two weeks and railroads have not been willing to accept freight of this character meantime. Quotations are from 50 cents to $2 less than those of two weeks ago.

BUFFALO.

The past week has naturally been a quiet one although several large sized contracts have been placed. Furnaces tributary to this market being practically sold up for the first six months of 1900, there is no evidence of pressure to sell. Shipments are still going forward as fast as the iron can be made and loaded, which is an unusual condition for this season. The scarcest quality on the list seems to be iron suitable for malleable manufacture. The quotations below are on the cash basis, f. o. b. cars Buffalo:

No. 1 strong foundry coke iron, Lake Superior ore, $24 to $24.50; No. 2 strong foundry coke iron, Lake Superior ore, $23.50 to $24; Ohio strong softener No 1, $24.25 to $24.75; Ohio strong softener No. 2, $23.25 to $23.75; Jackson county silvery No. 1, $31; Southern soft No. 1, $23.50; Southern soft No. 2, $22.50; Lake Superior charcoal, $26 to $27; coke malleable, $24 to $24.50.

OBITUARY.

Jacob J. Vandergrift.

Capt. Jacob Jay Vandergrift died at his home in Pittsburg Tuesday night, Dec. 26, aged nearly 73 years. He started as cabin boy on an Ohio river steamboat, later became captain and then owner of several vessels. He embarked in oil and gas operations and became prominent as an oil producer. With Joshua Rhodes and others he established the Pennsylvania Tube Works, at Pittsburg. At his death he was vice-president and a heavy stockholder of the Apollo Iron & Steel Co., a director of the National Tube Co., president of the Keystone Bank of Pittsburg, owner of the Vandergrift Bldg., Imperial Power Bldg. and Conestoga Bldg. The town of Vandergrift, Westmoreland county, in which the Apollo Steel Works are located was named after him. He is survived by several daughters, two sons, S. H. and Joseph B. and a brother, T. J. Vandergrift.

Edward H. Williams.

Dr. Edward H. Williams, of the Baldwin Locomotive Works, died Dec. 20 at his ranch near Santa Barbara, Cal. Dr. Williams was born in Woodstock, Vt., on June 1, 1824. He studied medicine and practiced for a time, but engineering was more congenial and he took up railroad work, being connected in turn with several Western railroads. In 1865 he went to Altoona, Pa., as assistant general superintendent of the Pennsylvania Railroad, and in the following year was made general superintendent. In April, 1870, he became a partner of the firm of M. Baird & Co., proprietors of the Baldwin Works, and maintained this connection up to the time of his death.

17,901,358 TONS FOR 1899.

A GREAT SEASON'S RECORD IN IRON ORE.

Nearly ten days later than the record, the last cargo of iron ore was loaded at the Escanaba docks last week, and figures are now available showing the movement of ore by water for the season of 1899. Complete returns from all upper lake docks give the unprecedented total of 17,901,358 gross tons. This is the tonnage of ore passing over the docks of Lake Superior and Lake Michigan into vessels. Shipments by all-rail routes, which were the largest in years, will undoubtedly bring the total up to 18,500,000 tons, if indeed that figure is not exceeded. The table below gives the record by ports, and corresponding figures for the years 1898, 1897 and 1896:

	1899.	1898.	1897.	1896.
Escanaba,	3,720,218	2,803,513	2,302,121	2,321,931
Marquette,	2,733,596	2,245,965	1,945,519	1,564,813
Ashland,	2,703,447	2,391,088	2,067,637	1,566,236
Two Harbors,	3,973,733	2,693,245	2,651,465	1,813,992
Gladstone,	381,457	335,956	341,014	220,887
Superior,	878,942	550,403	531,825	167,245
Duluth,	3,509,965	2,635,262	2,376,064	1,988,932
Total, by lake,	17,901,358	13,655,432	12,215,645	9,644,036
Total, all rail,	. . . .	369,241	253,993	290,792
Total shipments,		14,024,673	12,469,538	9,934,828

It will be seen that at 18,500,000 tons, the shipments by water and all-rail for 1899 will be nearly 4,500,000 tons in excess of the record-breaking year 1898—a surprising increase for a season opening so late and marked by high wild rates from the early summer to the close. The statistics showing receipts at the various Lake Erie ports are interesting in this connection, but returns are not yet entirely completed and the tables will be given in our next issue.

The past year has been marked by the large number of active mines and by the large shipments of certain of the more conspicuous properties. The Fayal mine on the Mesabi range sent down 1,070,255 tons, and the Mountain Iron 1,137,970. The prospects are that the Adams and Mahoning will come close to 1,000,000 tons each by another year. They were well above the half million mark this year. The Chandler, on the Vermillion range, shipped 808,359 tons. The Norrie, East Norrie, and Pabst, together made a total of 970,000 tons. The Chapin shipped 950,000 tons, and the Cleveland-Cliffs Iron Co.'s group of mines at Ishpeming went quite beyond 1,000,000 tons.

The Mesabi range made a total of 6,591,756 tons, as against 4,613,766 tons in 1898, or an increase of nearly 2,000,000 tons. It is expected easily to reach 8,000,000 tons in 1900.

New Rolling Mill in the Chicago District.

The Emlyn Iron Works, the incorporation of which at Chicago was noted by us December 7, has secured a tract of 13 acres of land at East Chicago, Ind., and will erect thereon a plant for the manufacture of iron and steel. According to the terms of the land deal the plant must be in operation within 90 days, employing 200 men, and 400 men must be employed within a year from now. These figures are said to be a minimum, the project contemplating much larger operations than this. The capital stock of the company is given in the incorporation papers as $145,000, but it is said the company is backed by some of the heaviest iron and steel men of Pennsylvania, and that the amount of money invested in the plant is ultimately to exceed $1,250,000. As an inducement to locate at East Chicago the town authorities have given the company a reduction of taxes to 35 per cent of the usual assessment and will furnish water to the plant for 3 cents a thousand gallons. The land was given the new company by the Calumet Canal & Improvement Co. and the Standard Steel & Iron Co., both of which are under the management of A. De W. Erskine, who conducted the negotiations for the location of the plant. The site selected is just north of the plant of the Republic Iron & Steel Co., and three-quarters of a mile southwest of the land purchased by H. C. Frick last year. The new company has already started work on its plant, the ground having been laid out, and some material purchased. Just who are back of it or are to be the managers has not yet been given out. In this connection it

is stated that there is more in the project for a large steel plant on the property at East Chicago owned by H. C. Frick than is popularly supposed, though any connection of Mr. Frick with the proposed enterprise is purely conjecture. It has been stated lately by persons who claim to know, that arrangements are being made now for the completion of the deal and that the plant will be built soon.

IRON AND STEEL STOCK MARKET.

Denison, Prior & Co., in their weekly letter on the iron and steel stocks, say: "A notable feature of the stock market of the week just past was that the steel and iron stocks, although freely hammered by the bears, were relatively stronger than many of the standard railway stocks. Steel and Wire was notably strong in the face of the semi-panic that existed in Wall Street, making the largest net gain recorded by any stock in the entire list, railroads, industrials and all. Federal Steel, Republic, National Steel, Tennessee Coal, and Colorado Fuel, while all showing net losses, were no worse off than the majority of the standard railroads.

"It could scarcely be expected that the severe shock sustained by the market last week could be overcome in a day, and for that reason we look for no persistent bull market this week—or until the January disbursements are out of the way. After these payments are made, however, we can see nothing in the situation to prevent a good upward movement—excepting, of course, possible disastrous reverses for the British arms in South Africa—and we look for the iron and steel stocks to enjoy a considerable portion of the advance."

Fluctuations of the Week and the Year.

The table below shows the changes in the iron and steel stocks in the week ending Dec. 26, also the high and low points of the year:

Name.	WEEK.				YEAR.			
	Open	High	Low	Close	High.		Low.	
Am. Car & Fdy.....	11⅛	13	10⅝	13⅛	27⅞	May 25	10⅝	Dec. 22
Am. Car & Fdy pr.	56½	57⅞	51	55¼	68⅝	Sept. 7	51	Dec. 22
Am. Steel & Wire..	37	43⅜	32	44	72	May 4	32	Dec. 18
AmSteel & Wire pr	90	91	84	87	106⅜	Mar. 13	84	Dec. 22
Am. Steel Hoop.....	40	40½	36½	39	48⅜	Nov. 28	24	May 24
Am. Steel Hoop pr	77½	79	75	79	86½	Sept. 14	70	May 13
Am. Tin Plate.....	26⅜	27	24	25⅛	53¾	April 4	20	Dec. 11
Am. Tin Plate pr..	75	76⅛	74	74	99⅜	Feb. 8	74	Dec. 22
Col. Fuel & Iron...	41½	41½	34⅜	37½	64	Sept. 11	30½	Feb. 8
Federal Steel.....	51	52	39¾	44¾	75	Apr. 3	39¾	Dec. 18
Federal Steel pr....	74	74⅛	67	68½	93¾	April 3	67	Dec. 22
National Steel.....	36½	37½	31⅜	36½	63	April 24	31¼	Dec. 19
National Steel pr..	90	90½	86⅜	86½	99⅜	Aug. 11	85	May 15
Pressed Steel Car..	53	53⅜	49	51½	61	Aug. 14	44¾	June 1
PressedSteelCar pr	80½	84	73	82	91	Sept. 7	75	Dec. 18
Republic Steel.....	19	19	16⅜	18½	33⅜	Sept. 6	16½	Dec. 19
Republic Steel pr..	63	64	60⅜	61½	79	Aug. 29	60⅛	Dec. 19
Tenn. Coal & Iron	81	81	64	77⅛	126	Sept 11	36	Jan. 14

LAKE SUPERIOR IRON MINES.

The Duluth, Missabe & Northern road has begun work on a third ore dock at Duluth. It will be 1,200 feet long, with a height to the deck of about 65 feet, 5 feet more than its present high dock. It will have about a mile of frontage, with 192 pockets, and will give the company a storage capacity for about 165,000 tons and a seasonal shipping capacity of about 5,000,000 tons.

John M. Thomas, of the Duluth Furnace Co., Duluth, will begin explorations on a 40-acre tract adjoining the Alpena and Sauntry mines, Mesabi range, where ore has been shown.

The Mahoning Ore & Steel Co. has put drills at work on the Roy property, close to Tower, Minn. The same company will do drill work in Sec. 16, 62, 14, east of Tower.

Estimates of the outputs of mines in the Crystal Falls district this year are made as follows Crystal Falls, 146,000; Columbia, 125,000; Mansfield, 82.000; Bristol, 80,000; Lamont, 67,000; Great Western, 43,000; Lincoln, 43,000; Dunn (estimated), 14,000; total 600,000 tons. The output in 1898 was about 260,000 tons.

Corrigan, McKinney & Co., of Cleveland, have leased the Tobin property near the Columbia, at Crystal Falls.

Rates of royalty on iron in the Vermilion field have advanced to 40 cents per ton. This is only another evidence of the anxiety of consumers to secure mines. Forty cents per ton may be legitimate in times like these, but it is altogether too high for long-term leases. A sliding scale based upon the selling price of ore at the mine is fairer and better for the district. Present prices for ore may be of brief duration and should any lessening of price result the 40-cent royalty would be considerably too high for the operator.—[Iron Ore, Ishpeming, Mich.

ADVANCEMENT OF APPRENTICES.

Of the many remarks made in the discussion of Mr. Higgins' paper on the education of machinists, foremen and mechanical engineers at the recent meeting of the American Society of Mechanical Engineers, few were more suggestive or appropriate than those of Mr. Christie. They were reported in our issue of last week, and it will be remembered that in describing the very enlightened treatment of apprentices at the Pencoyd Iron Works Mr. Christie gave it as his opinion that the keeping of a boy at the dull routine of operating some one machine is due, more than anything else, "to the inertia of the foreman," and that the real interests of the employer lie with the advancement of the boys through the opposite course.

While the inertia of the foremen may be, in some cases, the immediate cause of the too common practice, it is not usually, we think, the ultimate cause, and we do not think it just to require the foremen to carry the blame. That the position of a foreman is a difficult and perplexing one every one knows, and to the fact the paper and its discussion bear ample evidence. It must be remembered that before everything else, his business is to see that the work is turned out. From this standpoint there can be no doubt that the immediate interests of the employer demand that every employee be kept at the work with which he is familiar, which, in the case of the apprentice boy may be cutting bolts or operating a drill press. The foreman is not charged with the furtherance of his employer's intrests in a large way; he is charged with getting out the work in hand. Is it strange that he adopts the course best suited to accomplish the results which he is expected to accomplish? Is it not, in fact, unreasonable to expect him to adopt any other?

While we fully believe with Mr. Christie, that the employer will gain more in the end through the advancement of the boy than through the opposite course, it must be remembered that that gain is remote. So far as the work in hand is concerned, it is best furthered by keeping the boy at what he already understands. Add to this the increased attention demanded by a boy when placed on work which is new to him, attention for which the foreman can ill afford the time in the midst of his many duties and perplexities, and it is clear that there are many reasons besides mere inertia why he should do as he does. There can, in fact, be no doubt that in cases where the employer is not broad minded enough to realize the ultimate gain due to the boy's advancement, bearing in mind that the immediate gain due to the opposite course is as plain to him as to any one else, the foreman would be censured for changing the boy about. One can easily imagine the fine scorn with which many an employer would greet such an effort to advance what appear to him to be the boy's interests at the expense of what he considers to be his own, or to advance his own intersets through what he considers a finely spun theory with which he has no sympathy.

In other words, the method followed by Mr. Christie is necessarily a feature of the policy to be adopted by the management. No matter how clearly the foreman may see the ultimate advantages of such a policy, he is powerless to adopt it of his own volition. There is, in fact, an absolute conflict between the interest of the employer and the duty which he lays upon his foreman. Regardless of how enlightened the employer may be, the ever present necessity of immediate dispatch which confronts the foreman can have no other effect than to impel him to adopt, so far as possible, such measures as will accomplish the results expected of him. The employer is the man who must usually see the advantage of the enlightened course, if it is to be followed in any case.—[American Machinist.

OTIS, HOUGH & CO., dealers in iron and steel, Cuyahoga Bldg., Cleveland, in sending to the trade their annual vest pocket memorandum book, announce that they have been appointed exclusive sales agents for Northern Ohio, for light sheets manufactured by the old Meadow Rolling Mill Co., of Scottdale, Pa.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

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DECEMBER 28, 1899.

A PROSPERITY PANIC.

We doubt if any parallel to the following, taken from Dun's weekly review of trade last week, has been known in trade literature:

The worst day in Wall street for years was in part the legitimate result of the best year in business ever known. Because the country had prospered so greatly and had so expanded its business, it could no longer afford to have many millions locked up in carrying stocks representing imaginary values and a contraction of loans became necessary. The business of the country close to the holidays is larger than at the same date in any other year. There is not even a suspicion of unsoundness in any considerable branch of industry or trade.

It takes a lifetime to know all the varieties of panics. Last week's will go down as the "prosperity panic." Nothing more unequivocal has ever been written of any time of prosperity the country has known than is being written on the trade of the year now closing. Yet the very unmixed character of the prevailing prosperity in industry everywhere, brought a crash in that part of our commercial life which has so largely to do with the intangible—with hopes and fears, rather than realities. If earning power is any basis for stock values, some prodigious blunders have been made in the undervaluations of the past week; but the good has suffered with the bad, as in all such exhibitions of the mob spirit in finance. There are compensations, however, foremost among them being that further creation of industrial securities is impossible and will be for months to come, on any but the most conservative valuations and capitalizations. Those already made will be vastly helped by such forced limitation of the supply.

So far as the iron and steel stocks are concerned, they are peculiarly reinforced by enormous earnings, the reports of which have read almost like fables, as they have filtered out through various channels of information in the past six months. A computation made last week by one quite familiar with these earnings, showed that at the lowest points touched by the common stocks the total market values of the common issues very closely approximated the net earnings of the respective iron and steel consolidations since their formation. As for the preferred stocks, they represent in most cases the aggregate valuations of plants entering the consolidations, based on appraisement and on earnings as shown by their books. In the case of one company that might be mentioned, the equivalent of 7 per cent a year was earned in the five years following 1893, on the valuation at which it entered the consolidation to which it now belongs.

Saying nothing of the tried and seasoned managers at the head of most of them, the iron and steel consolidations, on their records and on reasonable expectations of the years immediately ahead, should give ample demonstration that they have suffered for the sins of others and not for their own, in the forcing down of their stocks in the past fortnight.

LAKE SUPERIOR ORE SUPPLY.

The suggestion that the iron ore deposits of the older Lake Superior ranges are being drawn upon at a rate to which they cannot respond for long, has been made not infrequently in the past few years of large outputs. From one quarter and another the answer is always made that the ore will be available in plenty as it is needed; and occasionally the intimation of a possible early scarcity is received with pity for the credulity that entertains the thought. The invariable response to those who argue that what has been found can be duplicated in the vast tracts of practically unexplored lands, is that while the possibility is granted, the finds have not been made. At no time in the history of the Lake Superior ranges have such diligent efforts been made on behalf of so many interests to bring to light new deposits as in the year just closed. And the salient fact is that, while dozens of little mines, many of them yielding inferior ore, have been started again because prices for the first time in years permit their operation at a profit, there have been absolutely no announcements of considerable additional finds. In this connection the following from *Iron Ore* is pertinent:

The present drain is a great one. Twenty millions of tons will be needed in the year to come, and it is only reasonable to assume that even this large amount will be inadequate in a few years to come. We well remember the time when the entire Lake Superior region contributed only one million tons. There are mines yet to be found. The Marquette range has tracts of land upon which only little has been done, and much has been looked over in a hap-hazard way. To the west of Ishpeming there is a chance for the finding of new mines. In the vicinity of Negaunee there may be new deposits added to the present number, but additions in the past 10 years have been few. The Menominee and Gogebic ranges have been fairly well explored and the Minnesota fields are showing little in the way of recent discoveries. All of these millions make sad-looking holes in the mines and the present reserve looks none too large in the light of shipping performances. It is not a difficult matter to estimate the probable tonnage of ore upon the older ranges or in the Vermilion range of the Minnesota field. New districts are being looked for in our own country as well as in Canada, the idea that there may be a shortage having grown considerably of late.

Another fact of present significance is that the estimates of probable production by old-range Bes-

semer properties in the 12 months beginning with the close of 1899 shipments, give a total less than the output of these properties in the shipping year just ended. These estimates were carefully made by mine superintendents who are thoroughly familiar with the properties, and the conditions under which operations will be conducted next year.

What the coming year will bring forth is still a sealed book. But from the experience of recent years and from the indications of the present, the company that now makes large investments in steel plant, in the expectation of providing its ore supply from Lake Superior ore properties yet to be found and developed, is leaving large leeway for the element of chance.

Some of the newspaper comments that have appeared recently, on the reputed prospects of "titanic struggles," "battles of the giants," "war to the death"—and so on for quantity—in the steel trade, are no doubt very interesting reading for the principals whose plans of campaign have been so obligingly and masterfully laid out for them. We are told by one able writer that such a war would break "the practical monopoly in the hands of wealthy corporations of the most cheaply available coal and iron ore lands, and of facilities of transportation," and that "out of the resulting competition consumers of iron and steel might hope to come by their own." One thing seems to be forgotten in the columns of steel war literature recently produced, and that is that business enterprises are undertaken with a view to profit and not loss. Industrial establishments often fight for a position that has been threatened, or even for existence when that has been menaced by a strong competitor; but it may be taken for granted that a coporation entering upon the manufacture of iron and steel at this stage in the development of the industry in the United States, does so with the intention of reaping the reward to which it is entitled. It need hardly be said to those familiar with the conditions as they exist to-day, that never has there been less temptation to rush precipitately into iron and steel manufacture, as at this very juncture, with prosperity at flood-tide. And this fact leads those familiar with the trade to discredit many of the rumors that have been rife in recent weeks, and that have found such ready currency among those whose acquaintance with the iron trade is from an outside standpoint.

According to the preliminary figures of the *Railroad Gazette*, which it says will probably be increased somewhat by the complete returns, the record for 1899 will be 4,557 miles of new railroad, built by 257 companies. For a year's total exceeding 4,000 miles we must go back to 1892 and 1891. In the four years following 1893 the average was only 2,000 miles. Last year the total ran up to 3,265 miles. It is to be said concerning the new trackage of this year that it represents almost entirely the response of the railroads of the country to the pressure of expanding business, and is in no respect like the unhealthy railroad building movements of the "seventies, many of which had no larger necessity for their being than that promoters' dreams should be realized. Another fact about the year's track laying, as it affects the iron trade, is the great increase it signifies in tonnage for the rail mills, over the requrements of a similar mileage in what were considered the real railroad building days of the country. An addition of 4,500 tons of railroad in a year means now 650,000 to 700,000 tons of rails, as against 450,000 to 500,000 tons 15 years ago.

The conditions of finance in foreign monetary centers—conditions that may attract more attention before the point of satisfactory adjustment is reached—furnish their own comment on the foolhardiness of the proposals that were so vehemently put forth in the last Presidential campaign. "Without the consent of any other nation" has a brave sound, and appeals to the swelling national pride; but for a country that in the midst of unparalleled prosperity finds its money barometer responding to cables of foreign wars and of a European struggle for gold, it can never be more than the cheap talk of a demagogue. The world's monetary meridian has not yet learned to follow the westward course of empire.

Personal.

Ambrose Swasey, of Warner & Swasey, Cleveland, sails for Europe in January, and will be abroad several months.

H. C. Frick is opening offices in rooms 918 and 919 Carnegie Building, Pittsburg.

Linn Bentley, manager of the three Hocking Valley furnaces of Miller, Wagoner, Fieser & Co., of Columbus, O., was presented with a gold-headed cane by the employes at Bessie Furnace last week.

Truman H. Aldrich, who is connected with the Southern Cahaba Mining Co. and who has been prominent in the industrial development of the Birmingham, Ala., district, will become officially identified with the Sloss-Sheffield Co. on Jan. 1.

W. J. Moore, the representative in this country of the American International Pump Co., and Mr. J. W. Downer, who looks after the interests of the National Tube Co., in the United Kingdom, are now visiting the United States, with the object of urging upon their principals the necessity of adopting a more energetic policy in England, where, they say, opportunities for a permanent footing have lately offered, especially through the last engineering strike.—[London Exchange.

An advance in wages that will affect nearly 14,000 men has been announced by the Carnegie Steel Co., Ltd., the past week. The following statement was made by the company: "The Carnegie Steel Co., Ltd., posted today (Dec. 22), at its various works in this vicinity, the Duquesne Steel Works and blast furnaces, the Edgar Thomson Steel Works, furnace and foundry, The Carrie Furnaces, the Homestead Steel Works, the Lucy Furnaces, the Keystone Bridge Works, the Upper Union Mills and the Lower Union Mills notices reading substantially as follows: 'Taking effect on Jan. 1, 1900, common labor at these works will be increased to $1.50 per day, and all other day, turn and tonnage labor (with certain exceptions) will be increased in proportion.' The exceptions are the tonnage men working under sliding scales where the rates of wages increase and decrease in proportion to the proceeds of the products, and also the men employed in several new sub-departments, which have been put into operation within the last two months, and for which new scales were made at the time in keeping with the present improved condition of business. This adjustment is 7.14 per cent advance on the wages now being paid, making a total of 25 per cent of increase made by the company, voluntarily, since the last general scale."

BEHAVIOR OF INDUSTRIAL STOCKS.

Mr. Archer Brown, of New York, makes this thoughtful analysis of the causes of the panic in stocks, particularly in the industrial corner of the market:

"The week closing has witnessed a sudden and extraordinary turn in Wall Street. Values tumbled so rapidly and confidence so quickly gave place to fear, that even the cool-headed wondered whether something serious was not the matter. The recovery was almost as violent as the attack, and almost in a day the clouds have lifted. All the causes sum up in three — tight money, congestion of industrial shares in the Street itself, and a bear campaign of extraordinary boldness and daring. Back of the tight money are two well understood facts, the needs of London growing out of the Boer war and the greatly increased needs of capital at home, growing out of the large volume of business on a higher basis of values. Allowing these two causes their full weight, there is nothing of which to be afraid. England is rich enough to carry on a great war, if not out of surplus revenue, certainly by a moderate increase of taxes. If she needs gold, this country can spare twice the amount needed from the increase alone in our national hoard in the past year. There is no more reason why we should shudder more at shipping her gold than pig iron, if she pays for it.

"As to the great demands of home trade, two facts only need be remembered. We have done a great business before on a smaller per capita of circulating medium. Indeed, the money supply is now not only the greatest per head in our history, but the soundest in character. It is probably true also that the business of the country is being done more nearly on a cash basis than ever before. We have an enormous reserve of credit for actual trade and industry, which can be drawn on if needed. We can afford to draw on it to carry on sound and profitable business.

"Turning to the overdose of industrial stocks, from which Wall Street has suffered, the facts are that certain private bankers and trust companies, under the stimulus of big promotion profits, have undertaken to finance many large undertakings. In consolidating industrial plants the operation, in most cases, has been to send large amounts of money to the West and South to pay for and improve properties. The shares are left in New York. The country at large gains. New York has to wait. Waiting was all right with call money at 2 per cent and industrial shares advancing in value. It is a different matter with money at 6 to 10 per cent and values of stocks declining. Banks began to discriminate against industrials. The congestion had to be relieved. A cloud of small speculators dealing on margins did the rest. Under such technical conditions, it made no difference how sound these industrials were, how free from debt, how great their earnings, they had to go.

"This was the great bear opportunity, and it was seized and carried out with vigor that astonished the country. It only needed the conjunction of two or three bad items of news in a couple of days—the failure of a new and highly speculative trust company and the defeat of Gen. Buller—to sweep the field. It would amaze the uninitiated to learn how thorough was the generalship of the bear army. The attack was made first in detail, then became general. Hundreds of thousands of shares were sold short on Saturday and Monday and covered before the day was over at huge profits. A very moderate show of strength by the holders of stock would have ruined the bear contingent, for they took colossal risks. As it was, the general-in-chief cleaned up $2,200,000 in a week, and is said to be going to Europe for a long rest.

"Whether legitimate business is to take up the scare where the speculative crowd leave it off is the question that concerns the iron and steel trade. It is safe to say that when the true nature of the disturbance is understood sensible men will go on with their plans, scarcely giving it a second thought. If they do reflect upon it the conclusion will be that it will postpone for years, if not prevent altogether, the smash that in time would have resulted, if there had been no check to the industrial reorganization craze.

"With labor everywhere well employed, with the farms prospering as never before, with the railroads overburdened with traffic, with our exports of merchandise increasing in spite of high prices, with a balance of trade still over $600,000,000 in our favor, with a sound currency assured by congressional action, with the Philippine war near its end, with new markets opening to us everywhere, and with 80,000,000 of people just emerged from a long period of economy and restricted action, and full of hope and confidence and vigor, it is safe to say that the year just opening will make pessimism and distrust a risky line of policy to pursue."

ALBERT M. CRANE.

Assistant General Manager of the American Steel and Wire Co.

Albert M. Crane, of Chicago, became best known to the iron trade through his connection with the sales department of the Illinois Steel Co. He resigned from that company early in the present year to become identified with the American Steel & Wire Co. as assistant general manager, with offices in Chicago, while the headquarters of General Manager Palmer are in Cleveland. Mr. Crane was born at Oswego, N. Y., Aug. 31, 1855. He became connected with the Boston office of Naylor & Co. in 1877, and afterward was attached

to the New York and Pittsburg offices in turn. In 1890 he accepted the position of assistant general sales agent of the Illinois Steel Co. and later was made general sales agent.

National Founders' Association.

The annual meeting of the National Founders' Association will be held at the Hotel Cadillac, Detroit, on Feb. 1. The association has grown rapidly in the West and Central West in the past year and Detroit is selected as central and easily accessible. The meeting promises to be the most important in the association's history. Issues that involve departures so radical that from five to 10 years might well be required for the educational work necessary to secure some measure of uniformity of practice in an industry so widely diversified, have been precipitated upon the foundry trade in six months, and the situation is one that calls for the best thought of all concerned. Probably at no time in years has there been the unrest in foundry labor circles that has been seen in the past year and that still exists. The National Founders' Association has been wise, conservative and conciliatory in all its dealings with the molders' and core-makers' organizations in the trying situations that have arisen thus far, and has made for itself a place among trade organizations that promises to become increasingly important. Its methods of handling labor troubles may yet be adopted by manufacturers in other lines.

The Brass Founders' Supply Co., of Newark, N. J., has just shipped a large order for its patent improved flasks to Bedford, England.

AMERICAN MACHINERY IN FOREIGN MARKETS.

The past three years have done much to familiarize American builders and shippers of machinery with the needs of foreign markets. They have been years of personally seeking out and meeting foreign buyers, and thus some of the things which obstructed the progress of our manufacturers with the export trade have been removed.

Frank M. Pierce, president of the Frank M. Pierce Engineering Co., New York, has spent a large portion of his time abroad since 1896, in Europe, Egypt, India, Australia, Asia, an the islands of the Pacific, making a special study of these various countries, and has obtained a thorough knowledge of their present and prospective requirements and the disposition of the people toward American products. The following embodies his views, as expressed in a recent interview:

Beginning with the electrical art or industry: The world acknowledges that the United States is in the lead, and because we have been through the expensive experimental stages of this new industry, the world recognizes that we have developed the business of electric lighting, transmission and tramway propulsion to such an extent that it is safe to follow American methods and practices, and to use American equipment—not only as relates to generators, motors and steam engines, but even down to the wiring system and the rails. This is evidenced by the fact that we find most, if not all, of the electric tramways now in operation or under construction in Great Britain, Spain, and to a great extent in Germany, equipped with American apparatus, and this is in a great measure true of large electric lighting plants. The application of electricity, even in the most advanced countries in Europe, is in its initiatory stage and has as yet to be largely developed.

In the extreme northern countries of Europe, Sweden, Norway and Denmark, there has been comparatively nothing done in this direction. But these energetic, intelligent, and in most ways wide-awake people, will not long remain out of line. These countries, however, do not offer an extensive field for electric tramways, as large cities are not numerous, and the sparse rural population renders cross-country roads a profitable impossibiltiy; the main development will be in the direction of electric lighting and manufacturing.

In Great Britain the unnatural prejudice against American machinery is largely disappearing, and English machine shops are not considered modern and fully up to date unless they are in whole or part equipped with American machine tools. American engines and mechanical appliances are finding a large and increasing English demand.

The market in Germany is as yet somewhat restricted, due to the fact that they are going through the experimental stage with German-built American machines; but recognition of the fact is rapidly gaining ground in Europe and elsewhere that American machines combine all the essential features of strength, adaptability, economy and beauty of design, while they are not unnecessarily heavy and clumsy; in other words, they are properly proportioned, the weight is concentrated at the points of greatest stress; they are adaptable, convenient and economical when built in America, but the foreign-built imitations are not liked. These features make our machines not only acceptable as working tools, but save greatly in cost of transportation. This is especially true of the modern steam engine. It is quite natural that the American land engine has been very highly developed. In fact, engine builders have been forced by our widespread and trying electric requirements to modernize and improve their engines to the greatest extent possible, even to experimental development of new types.

France still continues to supply in the main its own demand. Russia is largely supplying itself in the direction of electric apparatus and their accompanying engines from the United States. It is also a developing market for manufacturing plants. The demand for American goods, and in fact the electrical art, has as yet to be in the main developed in the balance of Europe. Greece is as yet solely engaged in unfolding and developing a new national life, and has but little money to expend other than in cultivating her now reviving agricultural interests. In Turkey there is but small demand for machinery of any kind. This is also true of Egypt, yet with the very slow but sure revival of this once rich country, now going on under the self-interested auspices of European nations, the growing interest in American machinery among the Europeans will in the years to come be reflected into Egypt.

India is in no sense a user of machinery—this, not because it is not naturally eminently susceptible to development in this direction, but manufacturing is not encouraged. To a careful observer this state of affairs appears an anomaly, because India does produce the raw material, and should manufacture it into the necessities required in the daily life of its 350,000,000 population. If not over-taxed, large amounts of capital could be profitably invested in manufacturing the cotton cloth required to clothe this immense population. That manufacturing will some day become an important factor in India can hardly be questioned, in view of its natural resources, and intelligent, industrious and high-minded people. While its dense population would cause the unobserving to look upon India as a remunerative field for exploiting the electrical business, the inherent habits of the people and their quite general distribution as a rural population does not make it an inviting field for the profitable investment of capital in this direction, excepting in the few large cities.

Passing on into Australia, one finds a large and growing demand for all kinds of American machinery and appliances. In fact, our goods have the preference in mechanical, mining, electric and manufacturing pursuits. This is also true in Japan, and in the present limited Chinese market. This Pacific trade—naturally tributary to the United States—must, in view of our recent island acquisitions, expand to an enormous extent, if the national and business problems are wisely handled; and business men must see that both are; it is a question of business, and not of any particular religion. The Pacific islands naturally supply their limited demand for mechanical apparatus from the United States. It is perhaps but stating the simple facts to say that, wherever American goods of any kind or description have been introduced, they have the preference, as they are denominated "honest" goods.

This condensed and hasty presentation of the world's markets as related to the present and growing demand for American products brings up two all-important factors which must receive adequate attention before American goods can be largely supplied to the world's markets. These deficiencies are, first, in the shape of proper transportation. Our goods must now be transported in foreign bottoms, which, controlling freight charges, can practically shut American products out of such markets as it is desired to reserve for their own flag's trade. This deficiency must, however, in the nature of things, be rapidly overcome by the building of an American mercantile marine, which naturally follows the growing naval armament of any nation. From present indications it appears that the money which has heretofore been turned in the direction of increased internal transportation facilities in America will now turn to the sea. Following these advantageous water transportation facilities, American houses will naturally be established abroad, so that guaranteed facilities now offered in foreign markets by the nations who at present control the export trade of the world can likewise be offered by America.

Reviewing the whole situation, the prospect for a rapidly growing foreign trade for American machinery is very flattering, and warrants intelligent study on the part of every person who is either directly or indirectly interested in the growth of America's commercial interests; for is it not through commerce that the nations of the earth are becoming better acquainted with each other, their interests becoming more and more interwoven, national boundaries and separateness broken down, and through these silently operating forces all humanity is unconsciously being drawn, through its selfish interests, into closer, more friendly and fraternal relations? If this is true, then behind the selfish commercial interest, a deeper, truer, common interest and unity is being brought about. If America will do her part in the new, coming commercial life of the world, in the same manly humanitarian spirit with which she opened up against tyranny, bigotry and oppression, she will prove herself the greatest "peace factor" among the nations; at least, this appears to be the world's opinion of us, as Mr. Pierce finds it.

CONICAL HOISTING DRUM.

A hoisting drum recently furnished by Fraser & Chalmers, of Chicago, on a second order for the Atlantic copper mine at Atlantic Mine, Mich., is shown in the accompanying illustrations. The capacity of the hoist is 6,000 lbs. ore raised at 3,400 ft. per minute, running in balance; the total load unbalanced being 22,000 lbs. The maximum depth is 4,000 ft. and the inclination of the shaft is 55° from the horizontal. This engine is reversible by steam. The engine is a duplex Corliss, non-condensing, having cylinders 24 in. diameter and 60 in. stroke. They are direct acting and are intended to take steam at 100 lbs. pressure. It is furnished with platform, indicators, etc., complete, and with a take-up drum for adjusting the length of the rope as it stretches.

The drum shown is of double conical form, with a cylindrical portion in the center, wide enough to carry 12 coils. The large diameter in the center is 25 feet 4 inches, and the drum tapers off at each end to 12 feet. The total face is about 22 feet, and it is grooved for 1¼-inch rope. There are band brakes, one at each end of the drum. They are set by weight and released by steam. The drum is fixed on the shaft. This drum was cast in four pieces, and these were afterwards split for convenience in shipping. The total weight of the drum is 280,000 lbs. finished. Fig. 2 is an interior view of half the big drum, as set up in the Fraser & Chalmers shop. The grooves of the drum were lathe-turned throughout.

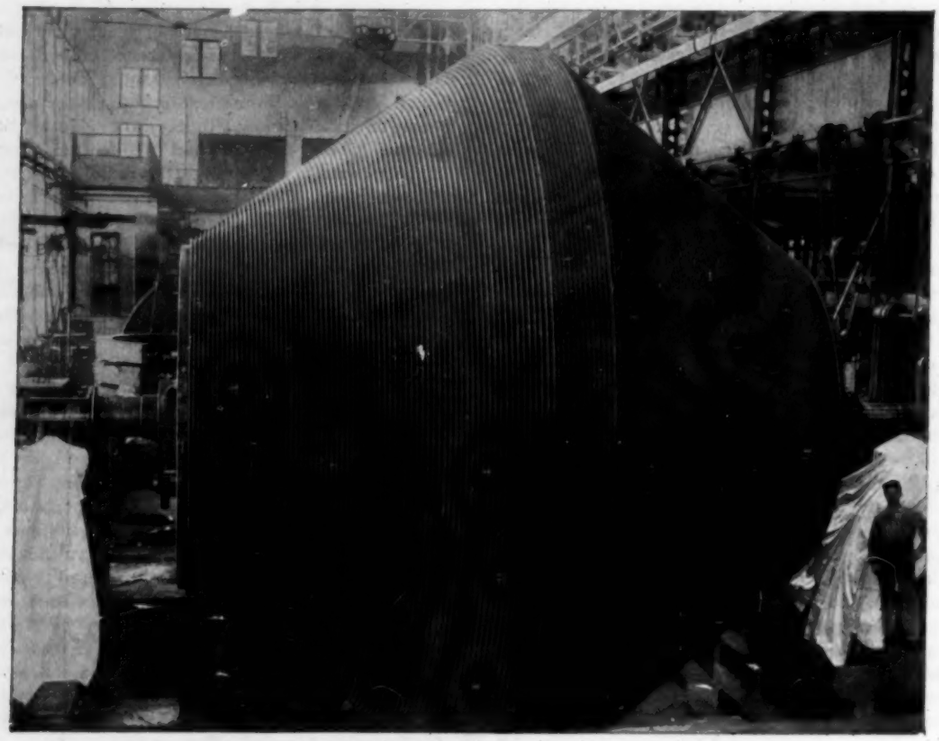


FIG. 1.—DOUBLE-CONE DRUM FOR ATLANTIC MINE.

Of the 25,000 h. p. of boilers ordered from the Cahall Sales Department by the American Steel & Wire Co., 10,000 h. p. is still to be delivered, and this portion will go to the Neville Island plant of the latter company. The Cahall sales office has made the following statement: "All the large industrial consolidations are preparing to make large additions to their motive power departments. Six of these will take in the aggregate 150,000 h. p. in the way of new steam boilers during the coming year. This will mean an expenditure of $2,000,000. The Carnegie Steel Co. has a big order in for new steam boilers, the American Steel & Wire Co., the American Steel Hoop Co., the Federal Steel Co., and other large concerns will enlarge their steam power capacity during the coming year. The individual firms are making similar arrangements, and the boiler makers of the country are going to have an extremely busy year."

THE VARIOUS COLORS OF HEATED STEEL.*

BY MAUNSEL WHITE AND F. W. TAYLOR, BETHLEHEM PA.

There is, perhaps, nothing more indefinite in the industrial treatment of steel, than the so-called color temperatures, and as they are daily used by thousands of steel workers, it would seem that a few notes on the subject would prove of general interest.

The temperaturee corresponding to the colors commonly used to express different heats, as published in various text books, hand books, etc., are so widely different as given by different authorities, it is impossible to draw any definite or reliable conclusion. The main trouble seems to have been in the defective apparatus used for determining the higher temperatures. The introduction of the Le Chatelier pyrometer within the last few years, has placed in the hands of the scientific investigator an instrument of extreme delicacy and accuracy, which has enabled him to determine the temperatures through the whole practical range of influence, and led to the establishment of new melting and freezing points of various metals and salts, which are now accepted as the standard in all scientific investigation. There has not, however, been published any results with the Le Chatelier pyrometer seeking to establish a correspondence of temperatures with color heats.

The first work done in this line, of which we are aware, is that of Dr. H. M. Howe, some eight or nine years ago. His results, however, have not been published, and with his kind permission we are enabled to give them here:

Dull red	625° to 550° C.	1,022° to 1,157° Fahr.
Full cherry	700°	1,292°
Light red	850°	1,562°
Full yellow	950° to 1,000°	1,742° to 1,832°
Light yellow . . .	1,050°	1,922°
Very light yellow .	1,100°	2,012°
White	1,150°	2,102°

The nomenclature used for color heats differs with different operators, but in our investigation we have adopted that which seems more nearly to represent the actual color corresponding to the heat sought to be represented. We have found that different observers have quite a different eye for color, which leads to quite a range of temperatures

*Read at the New York meeting (December, 1899) of the American Society of Mechanical Engineers.

covering the same color. Further, we have found that the quality or intensity of light in which color heats are observed —that is, a bright sunny day, or cloudy day, or the time of day, such as morning, afternoon, or evening, with their varying light—influence to a greater or less degree the determination of temperatures by eye.

After many tests with the Le Chatelier pyrometer, and different skilled observers working in all kinds of intensity of light, we have adopted the following nomenclature of color scale with the corresponding determined values in degrees Fahr. as best suited to the ordinary conditions met with in the majority of smith shops:

Dark blood red, black red	990°
Dark red, blood red, low red	1,050°
Dark cherry red	1,175°
Medium cherry red	1,250°
Cherry, full red	1,375°
Light cherry, bright cherry, scaling heat,† light red	1,550°
Salmon, orange, free scaling heat	1,650°
Light salmon, light orange	1,725°
Yellow	1,825°
Light yellow	1,975°
White	2,200°

†Heat at which scale forms and adheres, i. e., does not fall away from piece when allowed to cool in air.

must be largely depended upon; therefore, the training of the eye, by observing accurately determined temperatures, will prove of much material assistance in the regulation of temperatures which cannot be otherwise controlled.

M. D. TAYLOR, of Janesville, Wis., has designed and patented a woven wire fence machine that will weave field fence wire in widths from 9 to 67 inches. The sheeting, twisting, feeding and rolling devices are reported to be very effective, and the machine has been operated successfully.

THE Norristown Tin Plate Co., Norristown, Pa., received the silver medal and diploma on its high grade roofing tins at the Philadelphia Export Exposition.

THE executive committee of the National Association of Manufacturers has decided that the next annual convention of the association shall be held in Boston on April 24, 25, 26, 1900. Arrangements for this convention are now actively in progress, and it is expected that the coming annual gathering will in no way fall behind previous meetings, either in attend

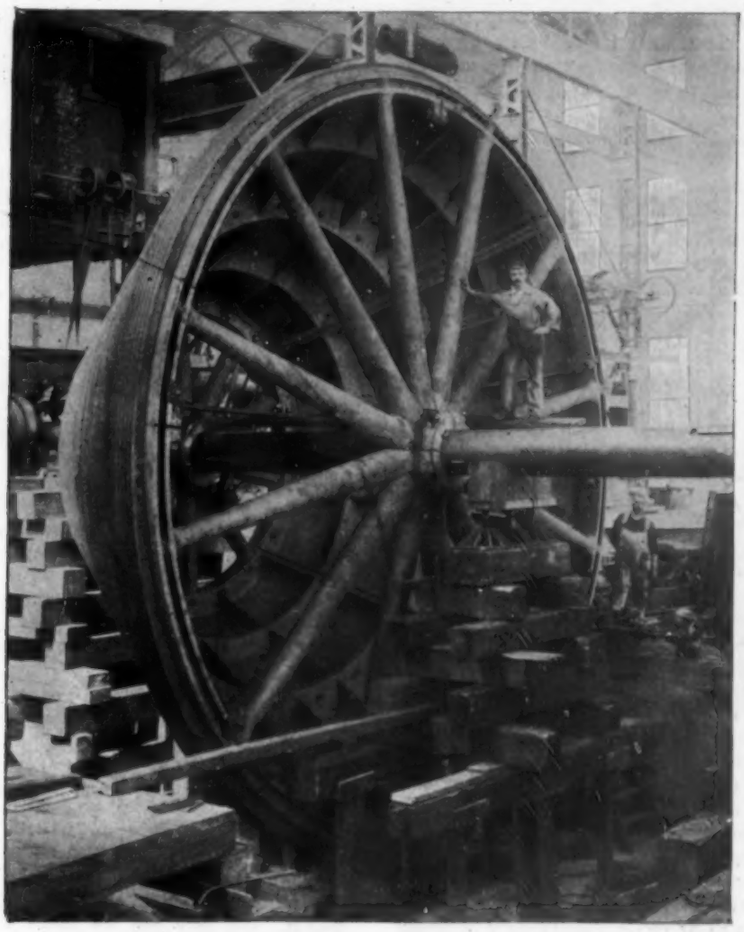


FIG. 2.—INTERIOR VIEW OF HALF THE ATLANTIC MINE HOISTING DRUM.

With the advancing knowledge of, and interest in, the heat treatment of steel, the foregoing notes, it is hoped, may prove of some value to those engaged in the handling of steel at various temperatures, and lead to further and wider discussion of the subject, with a view to the better understanding and more accurate knowledge of the correct temperatures. The importance of knowing with close approximation the temperatures used in the treatment of steel, cannot be over estimated, as it holds out the surest promise of success in obtaining desired results.

This demand for more accurate temperatures must eventually lead to the use of accurate pyrometric instruments; but at present the only available instruments do not lend themselves readily to ordinary uses, and the eye of the operator

ance or the importance of its discussions This will be the first meeting of the association in New England.

WARRANT stocks of pig iron in Great Britain were 563,998 tons on Nov. 27, against 677,560 tons on Jan. 1, 1899. The distribution was as follows, in gross tons:

	Nov. 27.	Jan. 1.
Scotch	264,193	316,507
Middlesboro'	77,292	146,430
Cumberland hematite	211,698	179,204
Middlesboro' hematite	10,815	34,419
Totals	563,998	677,560

The decrease in stocks since Jan. 1 was 111,699 tons.

Hon. E. B. Craig, of Nashville, Tenn., has resigned as state treasurer to become financial agent of the Virginia Coal, Coke & Iron Co., with headquarters at Bristol, Tenn., and New York City.

A NOTE ON FLY-WHEEL DESIGN.*

BY A. J. FRITH, NEW YORK CITY.

At a previous meeting of the society, a member of the society presented us with a drawing of a band flywheel, which had a rim of cast iron with shallow cross ribs, meeting in a pad on the under side, to which the arms were bolted. This wheel had accidentally been run up to an unusual speed, and was afterward found to be out of true. Upon examination it was discovered that about 50 per cent of the intersections of the arm pads and ribs on the rim were cracked around the entire wheel. In the discussion which followed, I felt called on to maintain that it was most remarkable that a cast iron structure could practically start to give way at almost every point, and still keep its integrity, and it still seems to me to be owing largely to the effort of the material not to part destructively, but to assume a form in which all its particles would be more equally strained. It was then suggested that perhaps we had not sufficiently considered the effect of the arms of a flywheel on its rim, when affected by centrifugal force, and that there might be something more to be considered in the designing of flywheels than is ordinarily laid down in our text-books regarding the mutual proportions of arms and rim. Subsequent consideration has only strengthened the views then expressed, and I would now beg to lay before the society a brief statement of what seems to be the cause of the accident related to us, and to suggest a possible remedy for it.

In designing a flywheel, it is customary to calculate the weight of the rim to fulfill certain conditions of diameter, and revolution of the wheel to obtain a limited variation of speed fixed by the load and duty of the engine. The arms of the wheel may be calculated as beams loaded at one end with forces which may be approximately determined by the maximum, and its possible widest variations of speed — conditions that vary so radically with the character of the work devolving upon the engine as to allow for wide latitude in proportion. It has also been advised to figure the section of arms to withstand the tension which would be produced if the entire centrifugal effort of the rim and arms were transmitted to the arms, a duty which it is evident they are never called upon to perform. For to do so the line of rim tensions would have to be so modified as to develop a radial effort equal to themselves, and they would have to make an angle (a) of 60 degrees with the arms, as shown in Fig. 1.

It is hard to suppose that any cast iron wheel whose rim was originally circular, no matter how thin and flexible it might be, could assume such a form without being destroyed. Nor could such a form be possible unless the rim should be stretched much more than the arms, and this assumes that the unit strains in the rim are larger than in the arms of the wheel.

Hence if the arms of a wheel are made of such a section that they will withstand the centrifugal effort of the wheel, they will probably not accommodate themselves to the extension of the rim, and especially in a band wheel with a light flexible rim, will tend to draw it in, and cause fractures at exactly the location where they did occur in the example already laid before us.

On the other hand, if the arms be so proportioned and so loaded that they will have the same unit strains as the rim, then they should extend to the same scale, so to speak, and there should be no tendency for the rim to be disturbed or lose its circular form, and fractures such as those shown us by Mr. McBride should not be expected to occur

Let W = the weight of unit of material, o = angular velocity, R = radius of the wheel in feet, f = the tension in the rim due to centrifugal force, c = the tension of an arm due to a unit of its own weight. Then

$$f = \frac{W}{g} o^2 R^2, \text{ and } c = \frac{W}{g} o^2 R$$

$c = \frac{f}{r}$ or the strain induced in the arm by the centrifugal force of a unit of its own weight is but $1 \div R$ times of that the rim tension, and this decreases as the position of the unit nears the center. The units near the center must, however, also withstand the pull of those further out, so that the final average tension at the arm is about 35 per cent of that of the rim tension per square inch. As the nave is, however, massive in construction, I have taken the average tension per square inch in the arm of a flywheel as 30 per cent of the unit tension in the rim, though this will vary with different diameters of wheel.

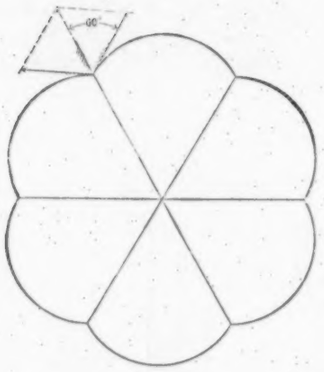


FIG. 1.

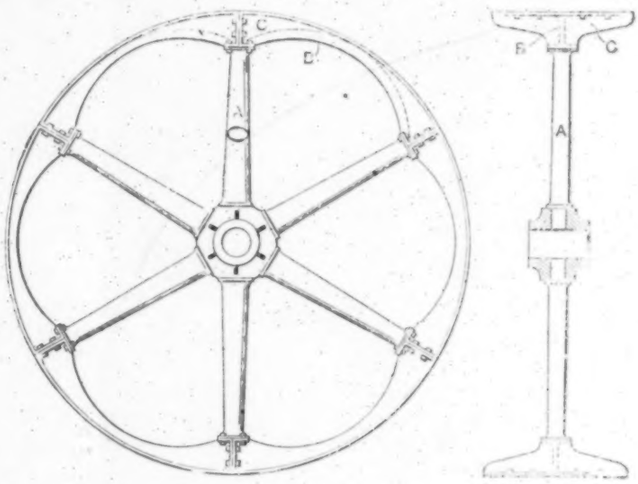


FIG. 2.

The above is tension developed by centrifugal force in the arm by its own weight, and is independent of its actual section. As it is considerably less than the rim tension, it appears impossible to have the arms stretch in unison with the rim, by its own weight alone, no matter how we may proportion it. But how can we throw extra effort on it without destroying the rim, when as in Fig 1 the shape of the rim which transmits its tension to the arm is far from circular? Can we not make part of the rim circular, and part as shown in Fig. 1, proportioning this second part with such a section that the arms will have an extra tension thrown upon them sufficient to bring the unit strains up to those of the rim sections?

In Fig. 2 I have shown a sketch that embodies this idea. The arms are to be made to withstand the strains which would be developed by the particular service the wheel is called upon to serve; that is, to drive the wheel, and to withstand the variation of speed without undue deflection. For this purpose the metal should be arranged in a section which gives the greatest rigidity with the least section, hollow arms and oval sections being particularly well adapted for the purpose. The weight of the total rim is figured to meet the condition of diameter, speed, and variation of speed desired.

*Read at the New York meeting (December, 1899) of the American Society of Mechanical Engineers.

Of this total weight of rim part is circular as shown, and a part is arranged in arches between the arms drawn to coincide with the natural catenary curve which the particles would take if free to arrange themselves to the forces induced. This curve is believed to be an ellipse, and is drawn to make an angle of 60 degrees with the arms. The section of the metal in this arch we will call B in square inches.

There is a further amount of metal at the end of the arm and between the circular and arch curves, which practical considerations and methods of fastening make necessary. This includes the bolts and flanges of both arms and rim sections, and we will call it C, and express it in cubic inches of metal. Let the section of arms already determined be called A in square inches. I would suggest the following formula in a six-armed wheel for finding the section of the arch, whose rise is one-fourth of the radius.

$$B^{\text{sq. in.}} = 70\% \ A^{\text{sq. in.}} - \frac{C^{\text{cu. in.}}}{\text{Radius in inches}}$$

From which we see how much less efficient is the material placed at the ends of the arms and that placed in the arch.

To insure that the stress should follow the line of the several arches, and not pass directly and parallel to the outer rim, openings in the metal at C will probably be advisable. It is believed that this method of reinforcing the rims of band flywheels in particular would obviate such accidents as that mentioned, and it has a particularly good feature in the depth of section immediately over the arms, where there should be no difficulty in providing a fastening of bolts whose total area would be sufficient to balance the total rim tension in the wheel, a condition which is so difficult to obtain under present conditions, although its necessity has been dwelt upon by every one who has treated and discussed the subject before us.

In the sketch the size and number of bolts shown, as well as the flanges, are not to be criticised, as no effort was made to proportion them to the probable strains; there does not seem to be any difficulty in providing *lugs* which would be sufficient. The rise of the arch B might also be reduced, though the section of B would then be larger than that given in this paper. The cross rib at the parting over the arm can be made the full width of the face, and deep enough to carry the centrifugal force of its own weight and transmit it directly to the arms; hence its presence can have no ill effect upon the rim however much it may extend beyond the arms.

Whether such a wheel can be made to compete commercially with those of present construction remains to be seen. Those who have suffered from the effects of a bursting flywheel will probably have a sufficiently healthy respect for its powers of destruction to pay what is necessary to prevent its recurrence.

FROM the standpoint of the Chicago market the *American Machinist* refers thus to the machinery trade at the close of the year: "Builders of power for machine shops are hardly gaining on their obligations. Whether the engine ordered is for 50 or for 2,000 horse-power, the chances are that the buyer will have to wait for it from one to three months if a small engine, from six to 15 months if a large one. This would be a serious hardship were all other classes of material and supplies promptly delivered, but the backwardness of shipments in structural material and other iron and steel work entering into construction unfits the engine house for its expected occupant on the specified date of delivery. There have been a number of instances where boilers and engines have been erected without a roof over them. Among some of the larger builders of engines the policy is to avoid rather than seek trade, for events that prove that they are not able to produce all the output they had hoped to, unexpected delays and stoppages in production occurring persistently."

THE American Tin Plate Co. announces that it will now take orders for tin plate for deliveries extending through the second quarter of 1900. Hitherto it has limited its sales to deliveries during the first quarter. This enables the buyers to cover their wants for the first six months of the coming year. The prices quoted are the same as those heretofore named for the first quarter of the year.

MOVING A MACHINE SHOP BY BARGE.

A novel method of removing a machine shop was resorted to a short time ago by H. Bickford, of Lakeport, N. Y., whose specialty is the manufacture of boring and turning mills. The site occupied by the shop was required by the Boston & Maine Railroad Co. in building new passenger and freight depots and in making other improvements. The new ground selected for the shop was about one-fourth mile distant, and the streets through which it would be necessary to take the buildings were narrow. As the shop stood at the water's edge it was decided to make the removal by water trip. Three barges were secured and two tug boats, one on each side. It required just one week to get the timbers under the main building, which was 40 x 80 feet, load it upon the barges and get it upon the new foundation, which also was located near the water's edge on Long Bay, Lake Winnipiseogee. The adjoining buildings were moved later and at the new site additions were built and several new and improved tools installed. In the removal the large tools were taken from the

shop and transported by other means. Small tools, shafting and traveling cranes were left in their places in the building.

AN affidavit of defense has been filed in the case of Peter L. Kimberly against Alexander M. Byers, an action to recover nearly $100,000, growing out of a mining stock transaction. The plaintiff alleged in his statement of claim that on Aug. 8, 1897, he owned 2,876 shares of Chapin mining stock, worth $25 a share. The stock was hypothecated to and held by M. A. Hanna & Co. to secure certain advances made to the plaintiff. Kimberly claims he made an arrangement to get a loan from Byers with the understanding that he would redeem the stock and make it over to Byers as security for his indebtedness to the defendant. He got $25,000 and certificates for the stock were forwarded to Byers. He now claims that Byers received $31,638.75 in dividends on the stock and that he subsequently sold the stock for $244,554.69. Mr. Kimberly admits owing Byers $277,683 33, but claims that the defendant having received $375,193.44 for the stock and dividends still owes him $97,510.11. In the affidavit of defense Mr. Byers admits the transaction up to a certain point. He denies that the $25,000 given Kimberly on August 8, 1897, was a loan, but says that he purchasd the stock outright for that sum; that he paid Kimberly the money and got the certificates. He denies his liability to the plaintiff, but says that Kimberly is indebted to him in the sum of $280,108.33, arising out of four notes. A replication has also been filed by the plaintiff in which he denies that he sold the stock to Byers for $25,000.

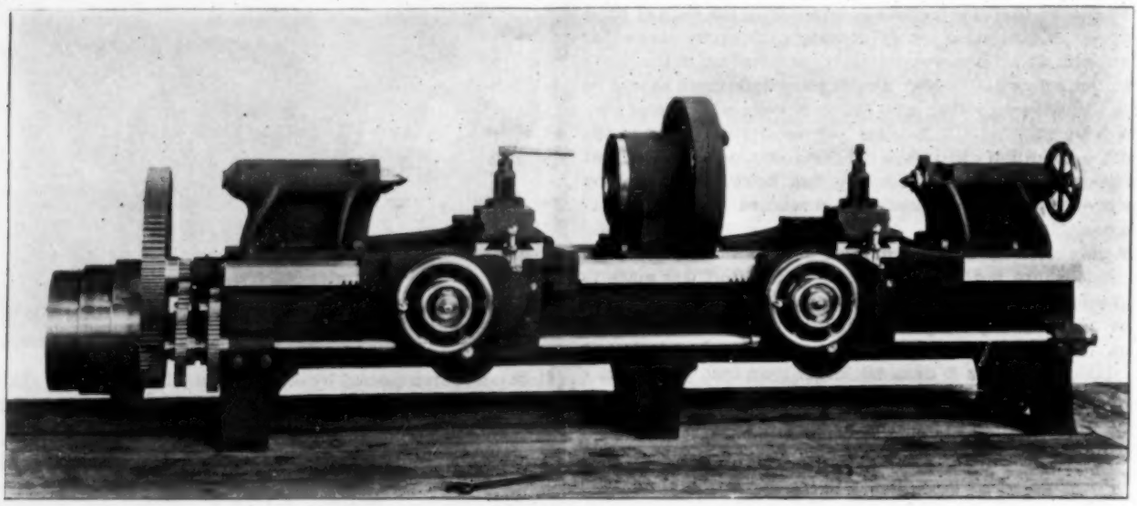
WESTINGHOUSE Electric & Mfg. Co. has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Jan. 2. Books closed Dec. 23 and reopen Jan. 3.

Carp River Furnace at Marquette, Mich., has been sold to the Pioneer Iron Co., an identified interest of the Cleveland-Cliffs Iron Co. It is stated that the output of the furnace will be increased considerably and a by-product plant is considered probable.

DOUBLE LOCOMOTIVE AND CAR AXLE LATHE.

The illustration below gives a view of a heavy double locomotive and car axle lathe, for turning both ends of car or locomotive driving axles at the same time. Power is derived from a 24 inch cone, having three changes for a 5-inch belt, and geared 30 times. If required, an electric motor may be used for driving, at an extra cost. The driving drum gear has a 12-inch hole for inserting the axles and is provided with a double self-adjusting driver. The carriages have rapid movement on the bed by hand wheels, through cut gearing to the rack. The tool slides, which are adjustable by crank handle and steel screw, have raised edges for draining the lubricant, and are made large enough to cover entirely their bearings. There are two feeds, which are positive and self-acting, through cut gears, splined shaft and cut steel rack, and may be instantly engaged or disengaged by hand wheels operating friction discs in the carriages. The sliding heads are adjustable on the bed; the right-hand one having a sliding spindle, which is clamped by a split bearing and bolt.

The center line of the axle is forward of the center of the bed, to afford easy access to work. An automatic pump and



DOUBLE LOCOMOTIVE AND CAR AXLE LATHE.

a crane for handling axles are supplied when desired. The manufacturers are Bement, Miles & Co., of Philadelphia.

Impact Tests of Cast Iron.

At the New York meeting of the American Society of Mechanical Engineers, last week, W. J. Keep, of Detroit, presented a paper on "Impact." Results were given of a series of tests to determine the action of cast iron bars under impact, the blows being delivered transversely to the length of the bar and the latter acting as a beam. The author states that he has been unable to devise any mathematical formulæ by which the deflection of a test bar of a given size with a given blow can be computed from the deflection of a test bar of any other size, or from the deflection of a bar of the given size with any other blow. He says: "There seems no better way to determine the resilience of a material than to support a test bar at the ends and deliver blows at the center. After a test bar has been tested in this way it is desirable to find its resistance to impact without any distortion as a test of brittleness. To do this a portion of the same bar should be clamped on the anvil of a testing machine so that one end shall project. Blows should be delivered on the projecting end. Mr. Barba has suggested taking a test bar of steel 1.181 inches square and filling a notch in the top and bottom, making the depth at that point only 0.835 inches. The object of the notches is to prevent any deflection before fracture. For general use it would not be safe to trust to the notches being made alike in shape and depth. For cast iron it would not do to cast the notch, as in cooling the fomation of the grains around the notch would greatly weaken the test bar.

"For cast iron it would seem best to leave the bar with its original section, and deliver the blows as far from the clamp as 1½ times the depth of the bar, which would be the proportionate distance suggested by Mr. Barba. An inch bar would receive lobws 1½ inches from the clamp and a ½-inch bar ¾-inch from the clamp. An examination of the diagrams obtained shows that some one size of test bar must be selected for comparisons. The size for cast iorn which would seem to give the best results is a bar 1 inch x 1 inch x24 inches, struck with a 50-pound hammer. This has the same relative proportions as a bar ½-inch x ½-inch x 1 inches, and if a 25-pound hammer is used, the record is the same as with a 1-inch x 1-inch x 24-inch bar with a 50-pound hammer; but this does not take into account the change in grain due to size of casting."

Resharpening Old Files.

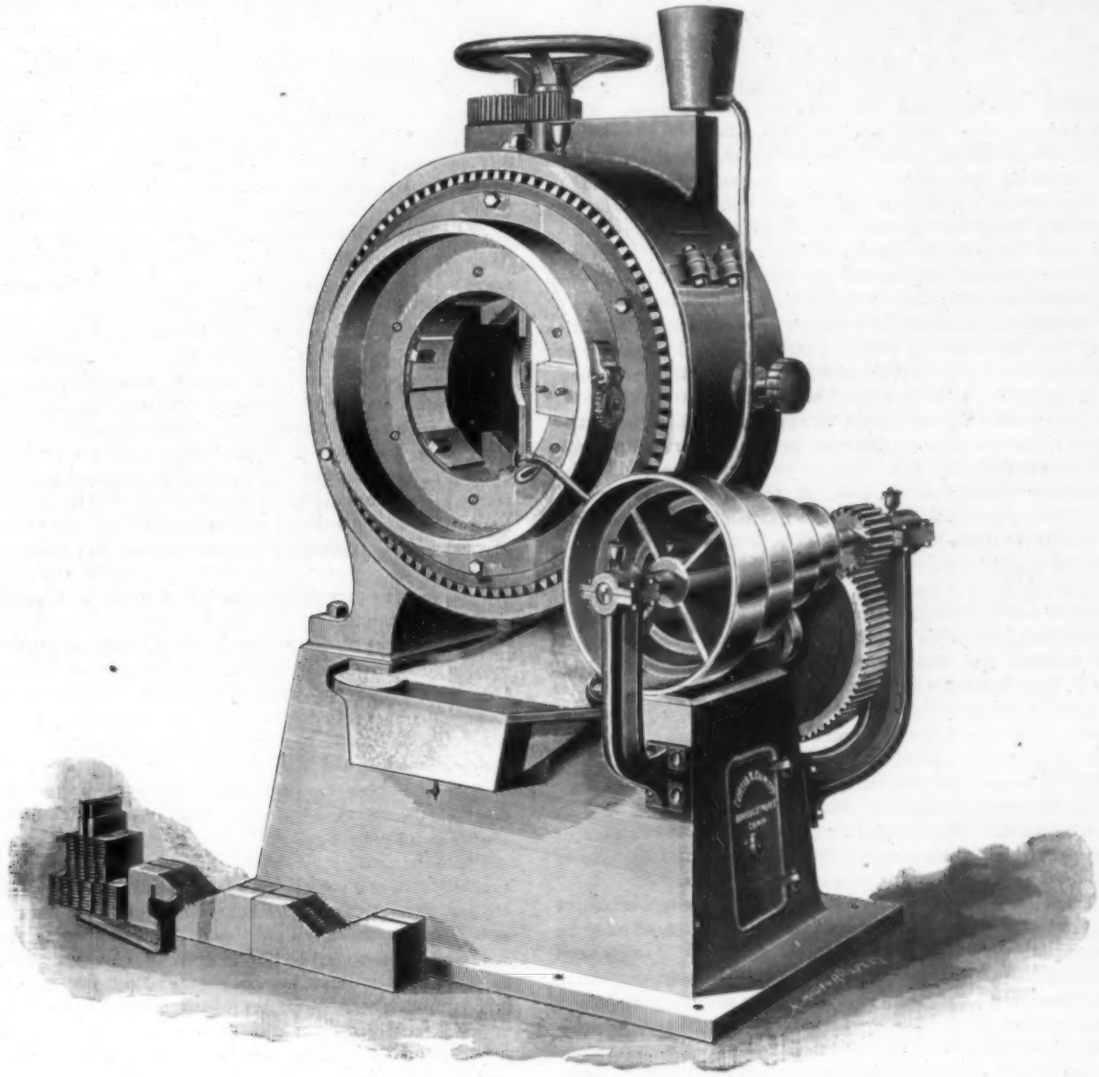
Apropos of a recently proposed electrolytic method of resharpening old files, we are reminded of the statement once made that, after all, the best thing to do with an old file is to throw it away and buy a new one. This has been the conclusion arrived at by a great many whose experience has extended over the once much-talked-of sand-blast file sharpening process and the methods of etching and recutting, all of which have been practiced with more or less success. Sand-blasting files has been claimed by some to be quite useless, as it makes the teeth shorter and simply raises an edge which has no durability. In recutting, the temper must be drawn, and the quality of steel used for files, or at least some of them, has been stated to be such that it deteriorates rapidly when rehardened. Right here, however, the point may be made, as, indeed, it has been by the advocates of recutting, that it all depends upon what grade of file one buys in the beginning. True economy ought to commence by purchasing that file which will yield the largest return for the outlay, and with this grade of file recutting has been claimed to pay. The grade which will not stand recutting is the cheap, common kind, and buying this has been characterized as a waste of money at the outset. Whether, with the best kind of file that money can procure, etching, too, is an economical sharpening process, remains yet to be definitely decided.—[Cassier's Magazine for January.

A JOHNSTOWN, Pa., dispatch says: "Fred. D. Barker and John A. Scott, representing the Lackawanna Iron & Steel Co., have filed 60 deeds in Indiana county, covering the purchase of 10,000 acres of coal in Buffington and East Wheatfield township. The conideration was $180,000."

Application will be made Jan. 1, 1900, by William G. Rice, O. K. Price, John Reed Scott, John Cowley, and Wm. B. Scaife for the charter of a company to be called the American Foundry & Pipe Co. The plans of the company are not yet ready for publication. The incorporators are of Pittsburg.

NEW PIPE CUTTING AND THREADING MACHINE.

Curtis & Curtis, of Bridegport, Conn., have placed on the market a new pipe cutting and threading machine, arranged to cut off and thread all sizes of wrought iron pipe from 2½ to 12 inches inclusive. The machine occupies a comparatively small floor space, and this permits of handling long lengths of pipe in the smallest possible room. The general principle is the same as in the smaller sizes of pipe machines for hand or power made by this firm. A die carrying gear is supported in a casting or shell, with the pinion imbedded in its side. On the back of the gear is placed a lead screw of the same number of threads to the inch as the pipe to be cut, which engages with the brass lead blocks, shown on the side of the shell, and which work out or in by eccentric. Thus as the



NEW PIPE CUTTING AND THREADING MACHINE.

gear revolves in the shell it is drawn back into the casing by the lead screw and the dies are brought on to the pipe.

In operating the machine, the pipe is placed through the self-entering vise attached to the back of the machine, with the end to be cut against the back of the dies, and securely clamped by turning the hand-wheel shown on the top of the machine. The dies are all opening and adjustable to any variation of the fittings by means of cams behind the dies on an annular ring. They are set for the size of the pipe to be cut by turning the ring to the corresponding graduation. In cases where it is desired to have the machine cut left hand threads as well as right, and casing and other threads in addition to standard, the machine is built with a pressure feed, instead of a lead screw.

THE 78th meeting (30th annual meeting) of the American Institute of Mining Engineers will be held at Washington, D. C., beginning on Tuesday, Feb. 20, 1900. Prof. Chas. D. Walcott, director of the United States Geological Survey, is chairman, and E. W. Parker, of the Mineral Resources division of the Survey, is secretary of the local committee.

Unparalleled Locomotive Building in 1899.

The *Railroad Gazette* makes a review of locomotive building in the year, from which we condense the following:

The total output of all the contracting locomotive shops in the United States (that is, those outside the railroad shops) for the year 1899, will aggregate 2,473 locomotives, the largest number for a single year yet recorded. The increase over last year is 598 locomotives, or about 32 per cent, and is about 10 per cent higher than the next best year, 1890, when the total output was 2,240 locomotives. Of the 2,473 locomotives that will have been built this year, 339, or nearly 14 per cent, will be compounds. In 1898 the output of compounds was 373, or 20 per cent of the total output. The export business for this year (514 engines) will show a decrease of 40, or seven per cent, as compared with last year, when 554 locomotives were built for railroads in foreign countries. In 1897, 386 were sent abroad, and in 1896, 309; that is, in 1897, 31 per cent of the total was ordered for export, and in 1896, 26 per cent. The following table shows the total number of locomotives built each year for the past ten years:

1899	2,473	1893	2,011
1898	1,875	1892	2,012
1897	1,251	1891	2,165
1896	1,175	1890	2,240
1895	1,101	1889	1,860
1894	695	1888	2,180

As in the preceding year, a number of railroads have placed orders for a large number of engines at one time. The largest order was that of the Chicago & Northwestern for 112 locomotives, given to one builder. During November and December orders have been placed for delivery in May, June and July, and in some cases as late as August.

QUESTIONS ABOUT CUPOLA MALLEABLES.

The following queries concerning the possibilities of mixed malleable and gray iron practice in the foundry are propounded in the *Tradesman* to Mr. E. H. Putnam:

"Do you know of any gray iron foundry plant that is making malleable castings in the same cupola from which it makes its common gray iron castings? If so, is not a different quality of pig iron used, and a different mixture from that used for gray iron? What then would be done with the sprue and over-iron that is left from the malleable heat? We use about 250 tons of malleables per year, and if the plan you suggest is practicable there is no good reason why we should not make our own malleables."

As we reproduced Mr. Putnam's answer to a previous query in the same line we give his comment on the above also, in view of the increasing number of foundrymen who are disposed to explore the mysteries of malleable:

"1. I do not know of any foundry making gray iron and malleable castings from the same cupola at present. But, for a period of five years, namely, from about 1884 to 1889, I manufactured chilled plow castings, agricultural machinery and malleable iron castings, all from the same cupola and at one and the same heat. In doing this I found no difficulty in separating the gray iron from the malleable iron. As a complete separation of the two mixtures is necessary, I will explain how this is accomplished, the more gladly as it is a rule of practice that will apply to many similar situations.

"Malleable iron castings are packed in heavy iron pots before going into the annealing oven. These pots should be made of very hard iron, though not so hard as is required for heavy malleable castings. It takes a good many of them to begin with, and they burn out, and must be replaced. The iron that is tapped from the cupola after the malleables are all poured and before the gray iron begins to come down, may be poured into these pots. If, now, all the hard iron is not out, pour it into pig molds. Draw the iron from the cupola as fast as it melts at this juncture, so as to be sure of draining out practically all of the malleable mixture before the gray iron mixture begins to come down. But now the question suggested to your mind is, 'How do you check the melting process at this point so as to insure the melting of the malleable iron without also melting the succeeding charge of gray iron'? It is as simple as standing an egg on end. Iron will not melt in the cupola above a certain point upward from the tuyeres; and, above another point somewhat less removed, it melts very slowly; therefore, when you wish to separate two widely different mixtures of iron in the cupola, put twice (or more) the usual charge of coke between them. Of course, this necessitates the burning up of extra coke to the amount of one or two hundred pounds; but that is a mere bagatelle as compared with the running of a separate cupola.

"Much greater exactitude is required in malleable mixtures than for gray iron; therefore melt the former first, so as to be sure of its being right. Remember, also, that, though hard iron is said to melt with less heat, it takes a much greater initial heat to make it sufficiently fluid for casting purposes. I would advise, for a starter, 50 per cent more fuel for malleable than for gray iron. I think this would be too much; but too much is immensely better than too little, as in the latter case you could not use the iron at all.

"2. Yes, a very different iron mixture is used in malleable iron. Gray iron castings must be soft; but malleables must be much softer, and ductile also. This is accomplished by several chemical operations. First, in the mixture, in conjunction with the operation of casting, the carbon is chemically combined with the iron. The physical evidence of this state is in a wholly white fracture. Then the annealing process affects the carbon in perhaps several ways. It may be that the oxygen of the 'packing' enters the heated iron, unites with some of the carbon and escapes with it in the shape of a gas. Perhaps, also, it changes the character of the carbon that remains in the casting. There is difference of opinion here. But neither you nor I need care a flip about this. It is enough for us that we know that the carbon must be wholly combined with the iron in the casting, or else the annealing process will leave the casting all honeycombed and 'rotten.' Do not use any foundry iron in making malleables. Though coke iron pretty well down to the Bessemer limit is used in making air furnace malleables, I do not now know whether this would answer in the cupola or not, but I shall probably be able to answer this question before long. About the equivalent of No 5 charcoal iron is right for light malleables.

"3. The sprues, scrap and over-iron are used in the next day's mixture. For this reason you cannot use all No. 5 iron, but you will probably make up a mixture from Nos. 2, 5 and sprue.

"As the manufacture of malleable iron is expanding very rapidly, and is already become one of the most important features of iron industry, I shall be glad to answer any further queries from any of our readers concerning the business, the more so since there is said to be but one malleable factory in the whole South, though the South consumes enough to employ half a dozen big ones."

ACTIVITY IN LOCOMOTIVE BUILDING.

Never before in the history of the Baldwin Locomotive Works has it turned out as large a product as it is doing today, and never has it employed so many men. Some idea of the business being done by the firm may be had from the figures of the last two months. In October, in 26 working days, 104 locomotives were completely built, an average of four per day. In November, with 25 working days, 92 locomotives were built and shipped. No other like establishment in the world has ever approximated that achievement.

It must be borne in mind that the locomotives of today are very much heavier and larger than those turned out but a few years ago. No railroad company now orders for its main lines, either for freight or passenger service, a 40 or 50-ton engine, such as were common 10 years ago; but the standard sizes now are from 90 to 120 tons. The increased size of freight and passengers cars and the greater length of the trains have compelled the building of engines large enough to haul them, and have also compelled the building of stronger bridges and the laying of heavier rails. The largest output of engines for any year prior to 1899 was in 1892, when the Baldwin works turned out 946 locomotives, or an average of over 78 per month.

Only a short time ago the Baldwin works shipped 36 locomotives for the African railroad, running from Bombassa to Ugandi, a distance of 300 miles, where it connects with the Cape railroad. Ten locomotives were yesterday being made ready for shipment to the Beneguelma railroad, a French government railroad in Algeria, on the Mediterranean coast of Africa. These locomotives are likely to become the principal civilizing agent in the "unexplored" regions of the globe, as they were called on the maps of the last generation.

The introduction of electrical machine tools has made a revolution in some branches of the manufacture. When two electric cranes were put into the erecting shop a few years ago, they dispensed with 300 men. One man now, by lifting his hand as a signal to the motorman, can at once pick up a smokestack or other heavy part, and set it in its place, the entire movement being under the direction of one will; the whole thing being done before he could have assembled his men under the former method. In the boring building the introduction of motors to operate the lathes also made it possible to use electric cranes, as these could not have been used in conjunction with the old-time shafting. It is interesting to note that the introduction of these labor-saving machines was a distinct advantage to the workmen, who now turn out more work and get better pay for it than before. The Baldwin works now employ 7,250 men.—[Philadelphia Public Ledger.

An Eastern comment on American Tin Plate Co. operations says: "Eastern mills of American Tin Plate Co. will close this week for stock-taking. Some Western mills will not close. A representative of the American Tin Plate Co. gave it as his opinion that earnings for 1899 would not be as great as generally anticipated by the public. The output for the year will not be 9,000,000 boxes, as they were unable to operate their mills to full capacity early in the year owing to the Amalgamated Association restrictions. Since July the new schedule permitted an increase of 10 per cent in some mills over previous production. A factor which operated against profits is that the company when starting a year ago were burdened with long time contracts at low prices, some of these contracts not being completed until recently."

THE BRITISH IRON MARKET.

The approach of the new year gives interest to the condition of the iron market abroad, as bearing in a way upon the situation in the United States and the duration of prices prevailing. We quote below the iron market review of the London *Iron and Coal Trades Review* for Dec. 15:

While the manufactured iron and steel trades remain in a very prosperous and satisfactory position, the pig iron warrant market is still disorganized and prices are falling. Makers' quotations show little alteration however, and as they hold out for their own figures, and refuse to make concessions, little business has passed. For finished material the demand continues strong, and general activity prevails all round. On the Continent the situation is practically unchanged.

Pig Iron.—Business is restricted by the disappointing state of the warrant market; but makers of pig are by no means disconcerted, having plenty of orders on hand. They have fixed upon 70s. as the quotation for No. 3 Cleveland G. M. B. pig iron, for both forward and prompt delivery, a price which consumers are naturally disinclined to pay with a falling market. It is noteworthy that warrants have this week touched a lower price than has been reported since the early part of September, having been 4s. 5½d. below the best figure in November, and 8s. 5½d. below the best price of the year. Forge iron is very scarce, and 68s. 6d. has been obtained for gray, while some makers are asking 69s. Hematite is in very inadequate supply, and 82s. 6d. is the price demanded for mixed numbers, although no business has apparently taken place at that figure. The exports from the Cleveland district up to the present time this month have been considerably above the average. In Barrow makers are quite unable to keep pace with the demand, although all the works are running at their full capacity, and the price asked for Bessemer mixed numbers varies from 78s. to 80s. South Staffordshire pig is in great request, and users are complaining a great deal as to the delay in deliveries, while in Lancashire there is not much business passing, and prices remain firm.

Manufactured Iron and Steel.—The demand for finished material of all kinds is as keen as ever, and makers are in a very strong position, being comparatively indifferent to new orders just at present in view of the increased cost of production and the probability that they will be able to obtain more favorable terms later on. In South Staffordshire £10 10s. is easily obtainable for best bars, and for common iron £9 10s. has been refused. North Staffordshire bars are quoted at from £9 15s. to £10, although there is as yet no official advance. Steelmakers are very busy, but fail to keep up with the requirements of consumers, and much disappointment is consequently occasioned. Prices show little change. Bars, plates, angles and ingots are all in brisk inquiry.

Comparison of Prices.—The annexed table shows the current prices compared with those of the preceding week, and of the corresponding period last year:—

	Dec. 14, 1899.	Dec 7, 1899.	Dec. 15, 1898.
IRON ORE—	s. d.	s. d.	s. d.
Rubio, Middlesbrough	21 0	20 6	14 9
" Cardiff	19 0	19 0	13 9
Pottery Mine, North Staffordshire	17 6	17 6	12 6
Hematite, West Coast (at mines)	17 6	17 6	13 6
PIG-IRON—			
No. 3 foundry, Middlesbrough	68 0	69 0	44 6
Warrants, "	66 0	68 1½	44 3
Scotch warrants, Glasgow	66 10	68 8	48 11
Hematite warrants, West Coast	73 0	75 9	56 0
Cold blast (foundry), South Staffs	117 6	117 6	100 0
Welsh hematite, Cardiff	82 6	82 6	—
MANUFACTURED IRON & STEEL—	£ s. d.	£ s. d.	£ s. d.
Marked bars, South Staffordshire	10 10 0	10 10 0	8 0 0
Common bars "	9 10 0	9 10 0	6 10 0
Steel rails, Middlesbrough	7 0 0	7 0 0	4 12 6
" West Coast	7 0 0	7 0 0	4 12 6
" Cardiff	7 10 0	7 10 0	4 12 6
Steel angles (eng.), Middlesbrough	8 0 0	8 0 0	6 12 6
" " Glasgow	7 15 0	7 15 0	6 15 0
Steel plates (ship), Middlesbrough	8 0 0	8 0 0	6 15 0
" " Glasgow	8 10 0	8 10 0	6 17 6
Tinplates, Bessemer I. C. cokes, South Wales	s. d. 16 0	s. d. 15 9	s. d. 10 9

Engineering and Shipbuilding.—These industries continue very actively employed in all branches, and although in the engineering trade new orders are not coming forward in some departments as rapidly as could be wished, the work in hand is sufficient to keep all branches fully engaged for some time to come. Stationary-engine makers, who have not been booking work so freely lately, are now picking up contracts more rapidly, while machine-tool makers are very busy, having quite as much work offering as they can place on their books for anything like early delivery. Locomotive builders and boilermakers are very actively employed, while hydraulic and electrical engineers are exceptionally busy. In the shipbuilding yards there is great activity, and it is satisfactory to see that new orders are now being given out more freely, despite the prevailing high prices.

Foreign.—On the Continent there is great activity in the iron and steel trades of France and Germany, but in Belgium the market is rather quieter for the moment, although there is no doubt that the lull is only temporary. There is a slight falling off in the demand for constructional iron in France, but the general condition of trade is unchanged. In Germany the great scarcity of pig is still a marked feature of the situation, and manufacturers are much inconvenienced thereby.

POWER CONSUMPTION IN MACHINE SHOPS.

The object of a machine shop, with its array of glittering machines, its maze of belts and long lines of shafting, is to remove a certain amount of metal from the rough casting. The shop which will do this with the least expenditure of time, labor, and coal is the best shop and will net its owners the largest returns. It may be well to note that the two elements of time and human labor are by far the most important. A good machine must do its work accurately and rapidly and must require the minimum of attendance, since the interest account and the pay-roll far outweigh the expense of power.

Admitting this, the fact still remains that a saving of power is not to be despised, and will help to tip the balance in the right direction. One who has not given the subject special attention would, doubtless, be astonished to learn how small a fraction of the power generated in the engine room finds its way to the points of the cutting tools. Stating the case roughly, for the ordinary machine shop every one hundred indicated horse-power of the engine may be thus distributed:

Friction of engine	10 h. p.
Line shafting	15 "
Belts and pulleys	15 "
Empty machines	15 "
Cutting metal	45 "
Total	100 h. p.

Even this efficiency would probably be realized only when all the machines were working at their full capacity. The power required to remove the surface of metal depends on the nature of the material and the shape of the cutting tool. Cast iron consumes the least power of any of the metals in common use, and the harder grades of steel the most power. To remove a pound of cast iron per hour on an engine lathe will take from 0.015 to 0.030 h. p., according to the nature of the tool, with a safe average of 0.025, or one-fortieth of a horse-power. To remove a pound of machinery steel per hour on the same machine will take about 0.04, or one twenty-fifth of a horse-power. Average engine lathes of from 14 to 20 inches swing will remove from 10 to 20 pounds of cast iron per hour when cutting at full capacity, and consume from one-quarter to one-half a horse-power in the useful work. In turning machinery steel, the same machines will remove from 5 to 10 pounds of metal per hour, at an expenditure of from one-fifth to two-fifths horse-power.

The power expended in running the machine alone will depend very much on its condition. The writer has seen the horse-power consumption of an engine lathe increase from 0.36 to 2.3 h. p. in a few minutes on account of the main spindle becoming dry. The power required to run the average lathe before mentioned, when empty and in fair working condition, will be from 0.04 to 0.16 h. p., exclusive of countershafts, the lower values being for slow speed, and the higher for fast speed. A tightening of the work between the centers may easily raise this to 0.30 or 0.40 h. p. If one-tenth of a horse-power be assumed as an average value of the machine friction and added to the cutting power, the total power consumed by an ordinary lathe will vary from three-tenths to six-tenths h. p., exclusive of counters and belts.—[Prof. C. H. Benjamin in Cassier's Magazine.

OXIDE OF IRON IN CUPOLA PRACTICE.

The effect that oxide of iron, when added in a cupola, would have upon the mixture, depends upon the amount of oxide added—upon the mixture itself—and the construction of the cupola. In ordinary cupola practice the oxide is to be avoided. When the cupola is high there may be a reducing action and some oxide reduced to iron. In this case there would be a small increase of iron, although some of the oxide may be reduced by the silicon in the iron, thus decreasing the ingredient. In the ordinary cupola the oxide is not reduced by the coke directly or indirectly. Some, perhaps, is reduced, as Prof. Turner and Gautier say in their articles on silicon in foundry practice.

Oxide of iron has a great tendency to attack, I might say, all the impurties of iron, meaning by impurities, the carbon, silicon, manganese, sulphur, phosphorus, etc. Oxide of iron plays the most important part in metallurgy in making malleable iron, wrought iron, steel, etc. In some cases oxide is added as roll scales, iron ore, etc., but in very many cases it is formed by the air oxidizing the iron. In malleable the air passes over the iron and oxidizes the iron to oxide; this oxide acts upon the ingredients of the iron; upon the silicon and manganese first, then at a higher temperature upon the carbon. In malleable wrought iron, etc., we want to reduce these ingredients, but in a cupola we do not. In a furnace we have this oxide in contact with the iron a long time; we can stir it in the iron and then let the impurities rise. In the puddling furnace this oxide, at a lower temperature, attacks the silicon and is slagged off, thus leaving a white iron high in carbon. This action of oxide upon molten iron is about the same in the cupola if it were in contact with iron long enough. Oxide of iron has a decided effect upon the casting, as it lowers the silicon. Wanting a given per cent of silicon in the casting, the mixture must be made higher in silicon if rusty scrap is used, than if it is not rusty. To use rusty scrap in order to bring down the silicon would be bad practice, as the mixture could be made lower in silicon to start on. While in the air furnace the body of iron lies quiet and all impurties rise to the surface; in a cupola this is not the case. In a cupola the iron runs out continually, or is tapped often, and the oxide does not have a chance to separate, but mixes more or less with the iron.

Here is the main trouble with oxide. The ladle contains some oxide; it acts upon the iron in the ladle and often makes the casting on the top side of mold full of small holes; blow holes with often a little, round, shot-like iron at one side. The iron itself is rotten. Of course, I am presenting an extreme case, and these different signs will show up more or less, according to the amount of oxide present. In the cupola there is always more or less oxide present, and the more, the lower the silicon. To counteract this, we add in the ladle, in the wheel foundry, some ferro-manganese. Most of this manganese is slagged off, combining with the impurties.

When melting old burnt grate bars and the like, we have a great deal of oxide of iron. The iron melts and oxide remains. This acts upon the molten iron and reduces the silicon. Oxide of iron itself is, I might say, infusible—it is a base and wants to combine with something. Silica is an acid. Hence in a case of this kind, if sand is added, the oxide forms a slag, and a more fusible slag, leaving cleaner iron. This is all there is to Mullen's silicated iron process, which made quite a stir for a while.

There is no advantage in adding sand to a grey iron mixture, unless a great deal of oxide of iron is present; then the sand helps to make a fusible slag. Silica or sand around the pig is an acid and combines with oxide of iron, limestone, etc., to form a slag. To get ride of this sand, limestone is usually added. When limestone is not used, the silica must combine with some other base, and as there is none, it must combine with the oxide of iron. Where the oxidation of the iron by the blast furnace forms enough oxide to combine with the sand to make a fusible slag, the slag runs off without lime.

Slags are of different kinds. They are classified according to the amount of silica to the amount of base, correctly, according to the amount of oxygen in each, and each has a different melting point. Now, whenever limestone is not used, the proportion of sand going into the cupola and the oxide of iron formed by the oxidation of the blast, may be such as to form a slag which is not easily fusible and which causes the cupola to work badly; while, if more oxide of iron were present, the slag would be more fusible and cupola work better, giving better satisfaction all around. In case of this kind, rusty scrap would do good, and the foundry foreman would be led to believe that the addition of oxide was a good thing. It surely would be until the slag was fusible. It would, however, be a great deal better to see that less sand be added, and if that could not be done, it is far safer to add a little limestone. Besides, lime has a great affinity for sulphur.

While oxide of iron is the greatest substance known to purify iron of its ingredients, it must be used at the proper place and in the right way. In the cupola, it is surely out of place for ordinary practice, and cannot be called a purifier, excepting in rare cases, as stated above, when limestone is not used and there is too much sand present.—[J. C. Mears, in Age of Steel.

COMMISSIONER GENERAL Peck has designated the International Freight and Transportation Bureau of the National Association of Manufacturers to assist exhibitors at the Paris Exposition in the forwarding of their exhibits. William C. Barker, Produce Exchange, New York, chairman of the committee of the association in charge of that work, states that, owing to the lack of storage room on the exposition grounds, it has been thought necessary to provide temporary storage facilities at the port of entry on the other side, where exhibits can be stored when discharged from the vessel, and held until wanted by the Bureau of Installation at Paris. Therefore the National Association of Manufacturers has arranged for the ocean transportation, warehousing for sufficient time and the transportation to the Exposition buildings for one charge, so that American exhibitors will know just what it is going to cost them for the transportation of their exhibits from the seaport of this country to the Paris Exposition buildings before shipment is made.

ON one phase of the stock market upheaval of the past week the *Engineering and Mining Journal* comments: "An element which certainly added to the trouble has been the lack of definite knowledge. The holder of stock in a company which makes full and careful reports is not likely to be carried away in a temporary scare; he knows just where he stands and what his stock is really worth, and he will not part with it for less, nor will he be seriously disturbed by a temporary fall in quotations. On the other hand, if the knowledge he ought to have is carefully kept from him, he and his company are both sufferers. The stock may be sold at a sacrifice and the company loses credit. 'Blind pool' tactics may answer in a boom period for a time, but they are sure to bring trouble in the end; and with each recurrence of disaster investors become more and more impressed with this fact."

IT has been frequently stated that the charter of the Carnegie Steel Co., Ltd., will expire by limitation in Jan., 1900, but from information that we regard as entirely trustworthy we are enabled to state that the charter does not expire until April 1, 1901. The limited partnership of Carnegie Brothers & Co., with a capital of $5,000,000, was formed on April 1, 1881. On July 1, 1892, notice of an increase of the capital stock was filed, with a change of name of the Carnegie Steel Co., Ltd., and purchasing the work and business of the firm of Carnegie, Phipps & Co. and other allied interests. This was still a limited partnership, which must expire by the limitation of 20 years attaching the old firm of Carnegie Brothers & Co.—[Bulletin.

A NEAT leather cardcase has been sent out by L. K. Hirsch, of the Rookery, Chicago, to his customers. It will be sent to any one asking for it. L. K. Hirsch is a large dealer in scrap iron and steel of all kinds, and makes a specialty of old steel rails for relaying. On page 2 of this issue is a list of some material which he offers for prompt shipment. Mr. Hirsch has at all times a large stock of material on hand and can make quick shipments on large orders.

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INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

The City Forge & Iron Works, Dayton, O., Andrew Plocher proprietor, are in the market for a wire crimping machine.

Frank F. Porter, 317 West 63rd st., Chicago, is in the market for a six h. p. gas or gasoline engine; one No. 6 Barnes lathe, foot power, 8-foot bed; one Sampso's sheet metal punch; one Green River or Buffalo drill. All must be in good condition and low priced for cash.

Fires and Accidents:—

The Fayetteville (Ark.) Foundry & Machine Shops were burned Dec. 16. The foundry will be rebuilt at once.

The machine shops of the Long Island Railroad on Newtown Creek, in the Hunter's Point section of Queens Borough, N. Y., were destroyed by fire Dec. 15. The building was filled with valuable machinery. Loss, $15,000 to $20,000.

Fire last week destroyed five houses belonging to the National Tin Plate Co. at Monessen, Pa., and injured a number of others. It is stated that the property was not insured. The loss is estimated at about $15,000.

New Construction:—

Plans for the plant the Louisville Bolt & Iron Co. will erect at Louisville, Ky., call for forge, threading, packing, and shipping departments and boiler and engine rooms. Plant will be one story and of brick or corrugated iron.

John Teetzle, of Ottawa, Ill., is figuring on removing to Marengo, Ill., and building a $5,000 plant for pumps and windmills.

The Illinois Car & Equipment Co., Chicago, is planning for a new steel shop for the manufacture of pressed steel cars, to be added to its plant at Hegewisch. It will be equipped with pneumatic riveters, electric cranes, presses, punches and shears.

It is reported at Chicago that the Emlyn Iron Works, whose stockholders are unknown, but some of whom are said to have been connected with the iron trade for years, has contracted with East Chicago, Ind., land companies for 13 acres and will build a mill for the production of merchant iron and steel. The site adjoins that of the Republic Iron & Steel Co.'s plant.

Work on the big pipe mill which will be erected at Columbia, Pa., by the Atlantic Iron & Steel Co., will begin soon, and it is expected to have the plant in full operation in six months.

Work is rapidly progressing on the plant of the Maryland Car Wheel Works at Curtis Bay, Baltimore, and it is expected that operations will be begun soon.

M. Hanna, of Madisonville, Ky., is erecting a foundry at Earlington, Ky.

The Inland Steel Co., of Chicago, has purchased a 20 acre site in Tonawanda, N. Y., near Buffalo, and will begin at once the erection of a mill which will employ between 300 and 400 men. The officials of the company say that the Chicago plant will be operated as usual, and that the increase of business has made the new plant necessary. It is expected that it will be ready for operation by next fall.

A project for a malleable iron plant is being canvassed at La Crosse, Wis.

At Cincinnati a permit has just been issued for a $17,000 plant for the Haven Malleable Casting Co.

It is announced that the Pennsylvania Road will build repair shops for the Cambria and Clearfield division at Cresson, Pa. Shops will also be built at South Fork to repair coal cars on the Berwind-White Co.'s extension into Somerset county.

The Buffalo, Rochester & Pittsburg will erect extensive repair shops at Dubois, Pa.

Fraser & Chalmers, 12th st. and Washtenaw ave., Chicago are receiving estimates for the construction of a large machine shop in connection with their plant at that location. It will be one-story, about 40 feet high, will extend over an area of 204x60 feet, and will be built of brick and stone.

The Pittsburg District:—

It is reported that the Apollo Iron & Steel Co. plant at Apollo, Pa., will be put in operation shortly after the first of the year.

At the annual convention of the Western Pennsylvania Central Mining Institute the following officers were elected: President, Thos. B. De Armit; vice-president, Charles Connor; secretary-treasurer, James Black; auditors, John Britt and Reuben Street. Mr. F. Z. Schellenberg is the retiring president.

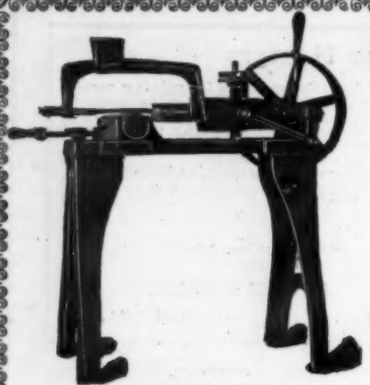
It is reported that the new move to consolidate the bath tub manufacturers is nearing a successful termination.

The Park Steel Co., Pittsburg, has purchased 50 acres of land at West Elizabeth, up the Monongahela river from Pittsburg, and will remove thither the plant in Pittsburg, which stands on ground the lease on which expires in 1901. Options on some adjoining land at West Elizabeth have also been taken but not closed yet. The price paid for the 50 acres was about $1,000 an acre

The new American Foundry & Pipe Co. which is about to apply for a charter expects to manufacture soil pipe at the Price Foundry, Jeannette, Pa. Wm. B. Scaife is one of the incorporators.

The Riter-Conley Mfg. Co. will begin work this week on the construction of a blast furnace for the American Steel & Wire Co. This is one of the two furnaces for which the company placed orders last August. It will be 23x100 feet in dimensions, with four hot-blast stoves, and a chimney, 200 feet high.

The Fischer Foundry & Machine Co., engine builders, of the South Side, Pittsburg, will erect a large addition to its present machine shop and install some new tools, which will considerably increase the output. The new building will be of iron and steel construction, covered with corrugated siding, and will be 75x150 feet in size. It will be equipped with electric motors for driving all the machinery. The electric equipment has been purchased from the Bullock Electric Mfg. Co., Cincinnati, and the General Electric Co., Schenectady,



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N. Y. Two 25-ton and one 10-ton electric traveling cranes, designed by the firm, will also be installed.

General Industrial Notes:—

The Stewart Iron Co.'s blast furnace at Sharon, Pa., has resumed, after being out three months for repairs.

H. Bickford, of Lakeport, N. H., manufacturer of boring and turning mills, has been full of orders since the completion of the improvements and additions to his plant and equipment a few months since.

It is reported that Salem, O., has offered to take $30,000 stock and give a site to the Ohio Steel Mfg. Co., composed of Canton capitalists largely, but not satisfied with the inducements given it to locate at Canton.

The directors of the Diamond Steel Co., Wilmington, Dela., have declared a dividend of 4 per cent on the paid-up capital of the company, payable Jan. 22.

The Davies Casting Machine Co., of Sharpsville, Pa., have received an order for one of their machines for the blast furnace of the Shenango Furnace Co., at Sharpsville, Pa.

The Rarig Engineering Co., Columbus, O., has the contract for two engines for the Thomas, Ala., furnaces of the Republic Iron & Steel Co. The engines will be of the cross compound staple type, with a new design air valve, and will require 750 tons of iron for their construction. Each engine will be 45 to 50 feet high, with a flywheel weighing 80 tons and 24 feet in diameter. They will be delivered in eight months.

The Moline Plow Co., Moline, Ill., moved into its new and thoroughly modern foundry last week.

The Central Steel Co. is expected to start up the Premier steel plant at Indianapolis, Ind., this week.

Philadelphia Furnace at Florence, Ala., starts this week.

At Sioux City, Ia., the consolidation is announced of the Sioux Iron Works and the Norfolk (Neb.) Foundry & Mfg. Co. The consolidated company will be known as the Sioux City Foundry & Mfg. Co. and will continue the operation of the Norfolk plant. E. A. Bullock will be president of the new company and Milton Perry Smith, of Sioux City, secretary and treasurer.

It is stated by Manager A. S. Matheson that the Youngstown plant of the National Tube Co. will receive improvements adding 50 per cent to its output. New gas producers and new furnaces will be added.

The plant of the Bridgewater Iron Works Co., Bridgewater, Mass., which comprises 15 acres of land and 12 buildings containing a floor space of 140,000 square feet, has been sold to the Stanley Iron Works, of New Britain, Conn.

The business of Howell & Saxton, iron founders, who for 40 years have been in operation in Brooklyn, N. Y., has been purchased by the Eagle Iron Works Co., of Brooklyn, Jacob May, president.

THE loss by the burning of the C. M. & St P. car shops at Dubuque, Ia., last week was $30,000. The plant will be rebuilt.

THE Pittsburg Improvement Co. will lay out a new town to be known as South Sharon, for the Sharon (Pa.) Steel Co.

THE Lidgerwood Mfg. Co., of New York, has sent to Mexico two mining hoists. The firm is also making a number of other foreign shipments, which must be completed before the end of the year. The demand from Mexico this season for its specialties has been extensive.

THE English Electrical Mfg. Co. is building under the supervision of Sidney H. Short a factory at Preston, Eng., with a capacity for turning out 2 000 railway motors and about 50,000 horse-power of dynamos per annum. The company has already booked orders including one from France for 800 motors for distribution throughout the Continent of Europe.

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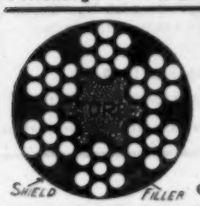

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The British Thomson-Houston Electric Co. is planning to erect near Rugby, Eng., a $2,500,000 plant, equipped with American machinery. In electrical apparatus for railroad purposes the British market is active, and there is a brisk demand throughout England for smaller types of dynamos for industrial purposes and for electric lighting. The British Western Electric Co. is said to be booking many orders for small electric appliances. From London it is reported that American trolley cars are being adopted all over Europe. Contracts for some 1,500 cars for various European electric roads will be closed early in 1900. Twelve hundred cars will be required for Great Britain and France. Purchases will be made for the equipment of the Barcelona and Bilbao street railways. At least 300 trolley cars will be required on these roads.

ACCORDING to the opinion of many people the disposition on the part of buyers of stocks to take advantage of the low-priced steel securities is due more than anything else to the entire probability that substantial dividends will be disbursed on some of them within the next three or four months. Although the industrial stocks are in a measure passing through an experimental stage, there are many people who are firm believers in their present as well as their prospective worth. After the leading industrial companies have fully demonstrated their ability to pay substantial dividends, it is held in certain quarters that it will serve as a pivotal point on which values of very many of them will gradually swing to a much higher level. The value of a stock is, or ought to be, based on its ability to pay dividends, is the argument presented in favor of the industrial group, and in time it is predicted that this rule will work just as well with an industrial as it does now, generally speaking, with a railroad stock.—[Wall Street Journal.

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For information about reduced fares, through time, and other particulars regarding Home-Seeker's Excursions to the South and West apply to Pennsylvania Lines Ticket Agents.

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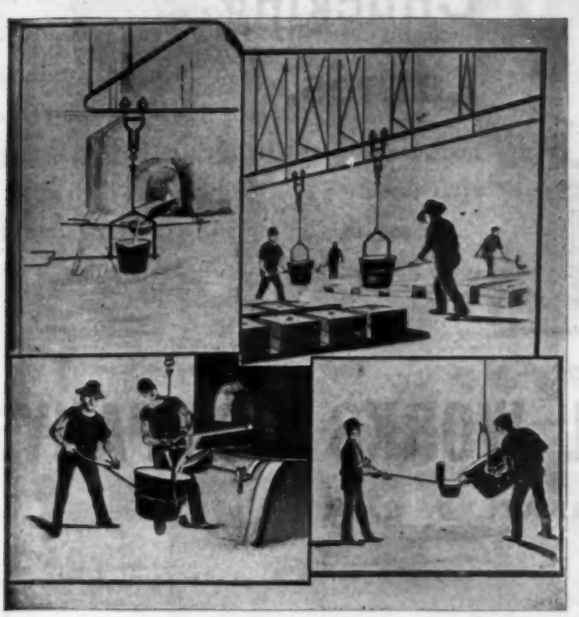

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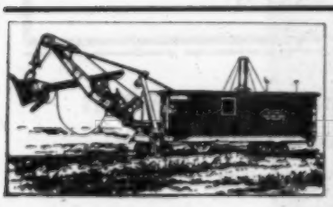

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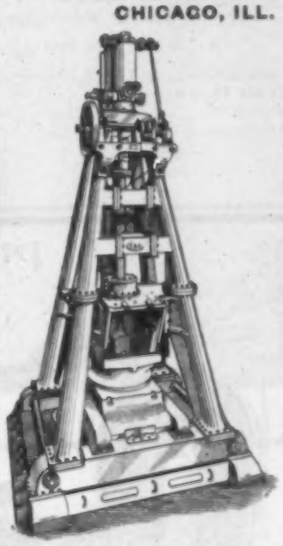

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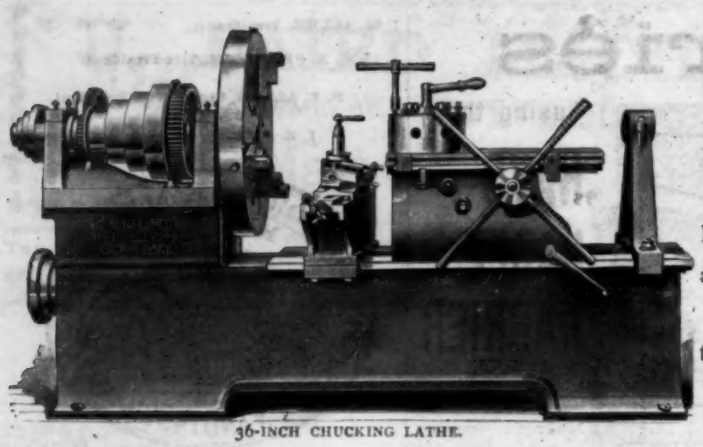

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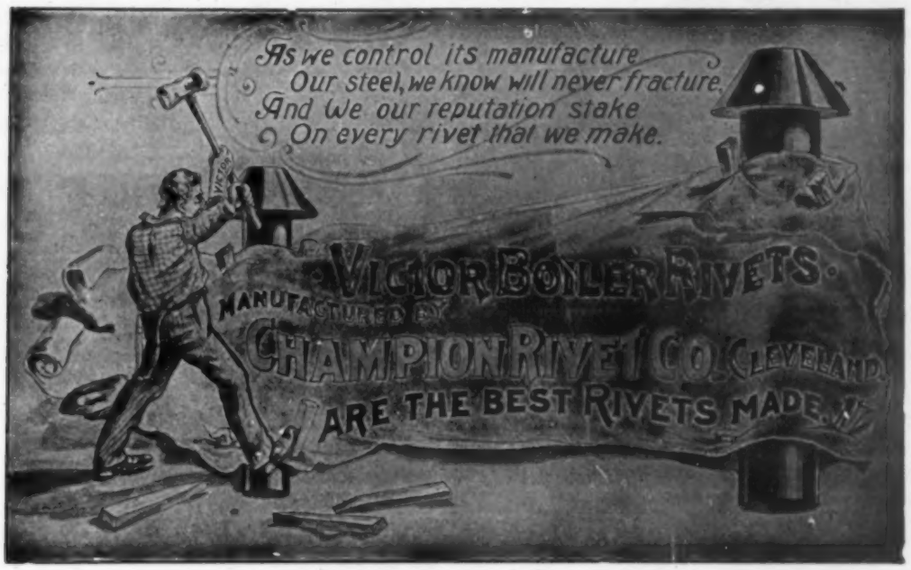
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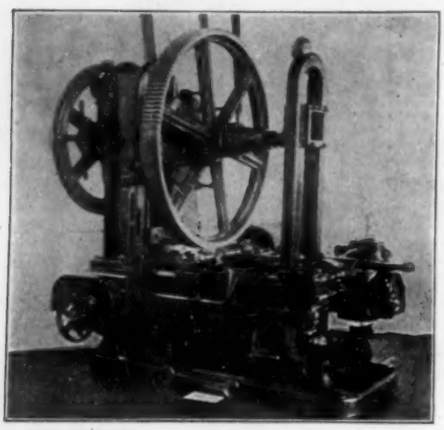

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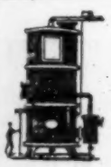

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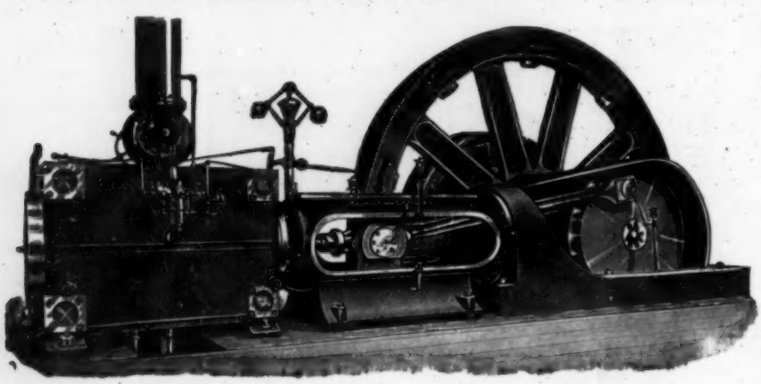

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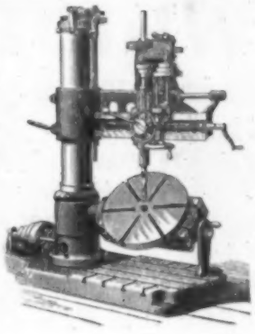

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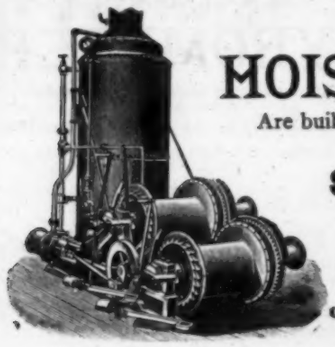

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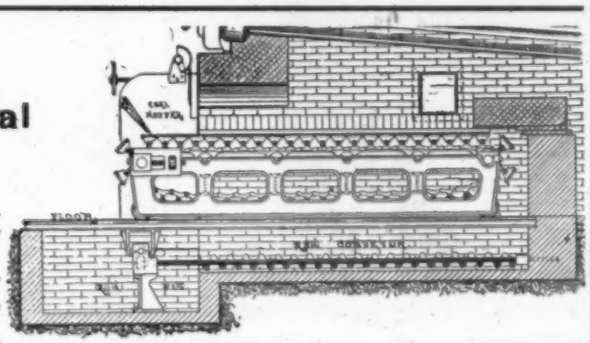

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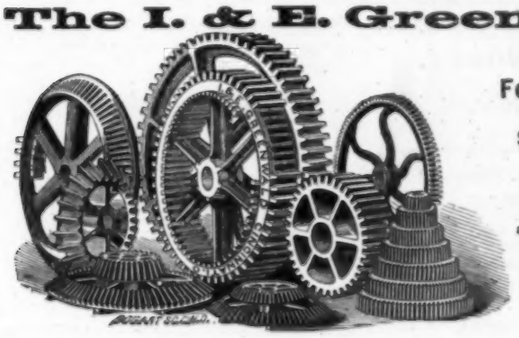

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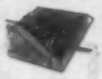

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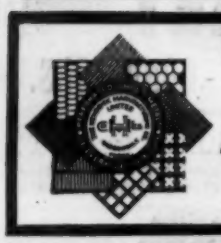

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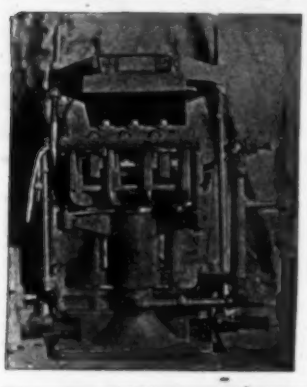

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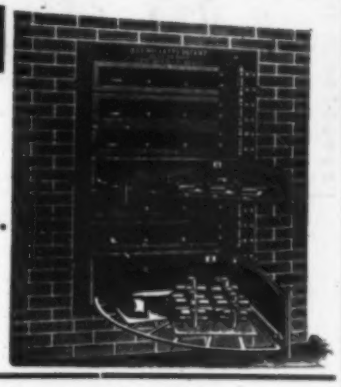

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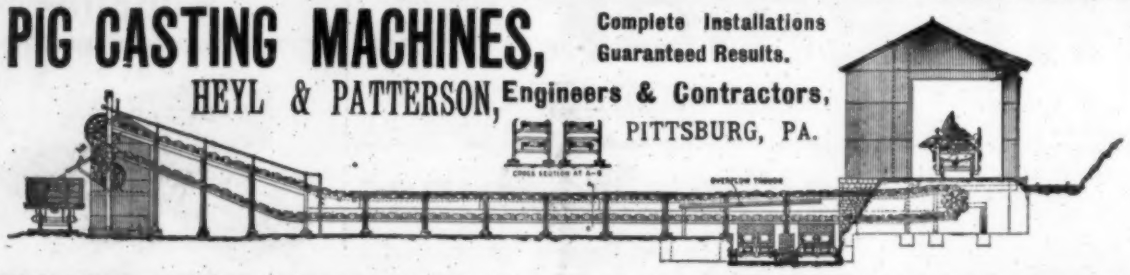

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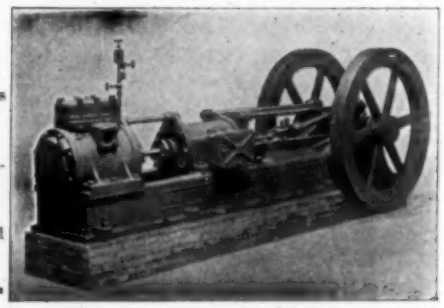

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The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

In the notes on blast furnace practice have been outlined the more important theoretical and practical points, which, it is hoped, will be of some service to those interested in the manufacture of iron.

The hygrometric table gives the necessary information for determining the amount of moisture in air, a subject whose importance in metallurgical operations is being more fully recognised at present than heretofore. This table is new and is based on the most accurate data available at the present time.

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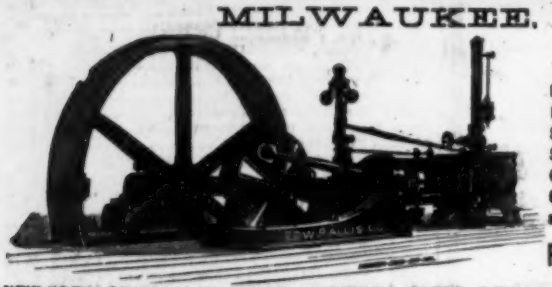

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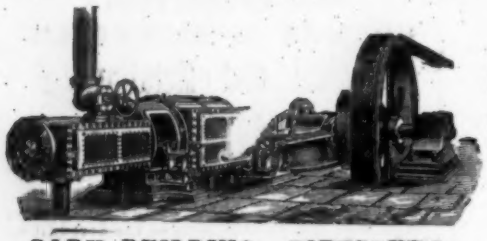

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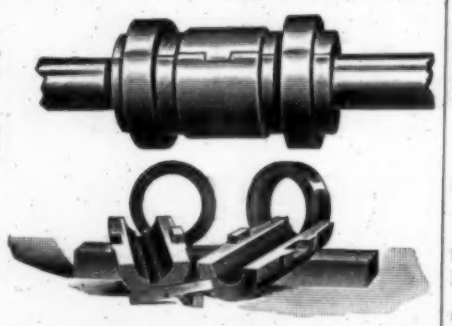

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Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.
Chas. Taylor's Sons Co. Cincinnati, O.

FIRE PROOF COVERING—
C. H. Besly & Co., Chicago, Ill.

FLEXIBLE SHAFTS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FLUE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Excelsior Iron Works Co., Cleveland, O.
Macbeth & Co., Cleveland, O.

FOUNDRY EQUIPMENT.
Miller & Hays, Akron, O.
Tabor Mfg. Co., Elizabeth, N. J.
Millett Core Oven Co., Brightwood, Mass.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Miller & Hays, Akron, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co., Cleveland, O.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton, Pa.

Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.
Millett Core Oven Co., Brightwood, Mass.
Cleveland Facing Mill Co., Cleveland. O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

FRICTION METAL—
James B. Clow & Sons, Chicago, Ill.
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Magnolia Metal Co., New York City.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago. Ill.

FURNACES—
Playford Stoker Co., Cleveland, O.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FURNACE, MELTING—
Whiting Foundry Equipment Co., Harvey, Ill.

FUEL OIL BURNERS—
W. S. Rockwell & Co., New York City.

GALVANIZED IRON—
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZERS—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & H. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

GRAY IRON CASTINGS—
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.

HACK SAWS—
Q & C Co., Chicago, Ill.

HANDLES—
Norwood Bicycle Co., Cincinnati, O.

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & H. Greenwald Co., Cincinnati, O.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

HEAVY HARDWARE—
C. H. Besly & Co , Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

HOISTS—
Reading Crane & Hoist Works, Reading, Pa.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O

HOISTING MACHINERY—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co., Columbus, O.
Excelsior Iron Works Co., Cleveland, O.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill.

IMPULSE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Universal Construction Co., Chicago, Ill.
Schiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.
R. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport O
Cincinnati Corrugating Co., Piqua, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
American Tool Works Co., Cincinnati, O.
H. Bickford, Lakeport, N. H
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Skinner Chuck Co., New Britain, Conn.
Baush & Harris Machine Tool Co., Springfield, Mass
W. P. Davis Machine Co., Rochester, N. Y.
Manning, Maxwell & Moore, New York City.
Bertsch & Co., Cambridge City, Ind.
Skinner Chuck Co., New Britain, Conn.

LADLES—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

LATHES—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LOCOMOTIVES—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

MACHINISTS' TOOLS AND SUPPLIES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
Baush & Harris Machine Tool Co., Springfield Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINE SHOPS—
The R. D. Nuttall Co., Allegheny, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MACHINERY AND TOOL STEEL—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

MALLEABLE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

MALLEABLE CASTINGS—
Acme Malleable Iron Works, Buffalo, N. Y.
Buhl Malleable Co., Detroit, Mich.
Forster, Waterbury & Co., Chicago, Ill.

MANUFACTURING CHEMISTS—
We Fu Go Co., Cincinnati, O.
Grasselli Chemical Co., Cleveland, O.

MANUFACTURED IRON AND STEEL—
Bourne-Fuller & Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.
Republic Iron & Steel Co., Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.

METAL BEARINGS—
Theo. Hiertz & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelshia, Pa.
Magnolia Metal Co., New York City.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co , Cleveland, O.

MILLING MACHINES—
American Tool Works Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Whiting Foundry Equipment Co., Harvey, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
W. S. Rockwell & Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.

ORE CARS—
The Pressed Steel Co. Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.
Forsythe Pattern Works, Youngstown, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON—
Rogers, Brown & Co., Cincinnati, O.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
R. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill,

PIG IRON CASTING APPARATUS—
Heyl & Patterson, Pittsburg, Pa.
G. H. Ginther, Special Agent, Pittsburg, Pa.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa.

PIPE CLEANERS—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.

PIPE FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill.

PLANERS—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
American Tool Works Co., Cincinnati, O.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chcago, Ill.
Universal Construction Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.

PNEUMATIC TOOLS—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago. Ill.
W. J. Schaefer & Co., New York City.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER DROP HAMMERS—
Baush & Harris Machine Tool Co., Springfield Mass.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago. Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.

PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Baush & Harris Machine Tool Co., Springfield, Mass.

RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
L. K. Hirsch, Chicago, Ill.

RELAYING RAILS—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.

RIVETS—
Champion Rivet Co., Cleveland, O.
Jonse & Laughlins, Ltd., Pittsburg, Pa.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.

ROLLING MILL MACHINERY—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. B. Phillips' Sons Co., Philadelphia, Pa
Whiting Foundry Equipment Co., Harvey, Ill.

ROOFS—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCRAP IRON—
L. K. Hirsch, Chicago, Ill.
Hyde Bros. & Co., Pittsburg, Pa.
Universal Construction Co., Chicago, Ill.

SCREENS FOR COAL, ORE, ETC.—
Robt Aitchison Perforated Metal Co., Chicago.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.

SCREWS—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill

SCREW MACHINES—
Cleveland Ball & Screw Co., Cleveland, O.

SECOND-HAND MACHINERY—
L. K. Hirsch. Chicago, Ill.
Hyde Bros & Co., Pittsburg, Pa.
Geo. D. Moffat & Co., Chicago, Ill.

SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.

SHAFTING—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Bethlehem Steel Co., South Bethlehem, Pa.
American Steel & Wire Co., Chicago, Ill.

SHAPERS—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
American Tool Works Co., Cincinnati, O.

SHEARING AND PUNCHING MACHINERY—
Bertsch & Co., Cambridge City, Ind.
Danielson Machine & Tool Co., Cleveland, O.

SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SHEET IRON—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago. Ill.
Republic Iron & Steel Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SOLID STEEL SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SPIKES—
L. K. Hirsch, Chicago, Ill.

SPECIAL MACHINERY—
American Tool Works Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.
Avery Stamping Co., Cleveland, O.
Q & C Co., Chicago, Ill.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.

STACKS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STAND PIPES—
The Wm. B. Pollock Co., Youngstown, O.

STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co., Chicago Ill.

STEAM PACKING—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

STEAM PUMPS—
Hall Steam Pump Co., Pittsburg, Pa.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

STEAM SEPARATORS—
James Bonar & Co., Pittsburg, Pa.
Austin Separator Co., Detroit, Mich.
Harrison Safety Boiler Works, Philadelphia, Pa.

STEAM SHOVELS AND DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

STEAM SPECIALTIES—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

STEEL—
Otis Steel Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
Struthers Iron & Steel Co., Struthers, O.

STEEL BALLS—
Cleveland Ball & Screw Co., Cleveland, O.
Norwood Bicycle Co., Cincinnati, O.

STEEL BANDS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co Chicago, Ill.

STEEL BLOOMS AND BILLETS—
American Steel & Wire Co., Chicago, Ill.
National Steel Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
American Steel Hoop Co., Pittsburg, Pa.

STEEL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

STEEL CASTINGS—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.

STEEL CEILINGS—
Berger Manufacturing Co., Canton, O.

STEEL FRAME MILL BUILDINGS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STEEL FOUNDRY PLANTS—
Whiting Foundry Equipment Co., Harvey, Ill

STEEL HOOPS—
American Steel Hoop Co., Pittsburg, Pa.

STEEL PLANTS—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.

STOKERS—
Playford Stoker Co., Cleveland, O.

TANKS—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
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Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.

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Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.

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Northern Engineering Works, Detroit, Mich.
Miller & Hays, Akron, O.

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WIRE—
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National Tube Co., Pittsburg, Pa.

Alphabetical List of Advertisers.

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

	PAGE
Acme Malleable Iron Works	2
Ætna-Standard Iron & Steel Co	30
Ætna Fire Brick Co	33
Aitchison, Robt, Perforated Metal Co	32
Allis & Co., Edward P	42
American Carburizing Co	34
*American Pneumatic Tool Co	29
American Steel Hoop Co	38
American Steel & Wire Co	37
American Tin Plate Company	39
American Tool Works Co	26
Apollo Iron & Steel Co	1
Armstrong Bros. Tool Co	1
Armstrong Mfg. Co	29
Aultman Co	2
Austin Separator Co	47
Avery Stamping Co	48
Baird Machinery Co., U	24
Baker Mfg. Co., James H	26
Baush & Harris Machine Tool Co	48
*Berger Mfg. Co	—
*Bertsch & Co	—
Besly & Co., Chas. H	48
Bethlehem Steel Co	47
*Bickford Drill & Tool Co	29
Bickford, H	48
Blair & Co., Reed F	2
Blakeslee Mfg. Co	1
Bonar & Co., James	28
Bourne-Fuller Co	I-2
Bræburn Steel Co	35
Brass Founders' Supply Co	33
Brier Hill Iron & Coal Co	24
Bristol Co., The	1
*Brown, Edward	—
Brown Hoisting and Conveying Machine Co	31
Bucyrus Co	25
Buhl Malleable Co	23
Cahall Sales Department	1
Central Electrotype & Engraving Co	41
*Champion Rivet Co	27
Chicago Drop Forge & Foundry Co	1
Chicago Fire Clay Product Co	33
Chicago Press Clipping Bureau	31
*Chicago Rawhide Mfg. Co	30
Chicago Screw Co	1
Cincinnati Corrugating Co	1
Clayton Air Compressor Works	2
Clearfield Fire Brick Co	33
Cleveland Ball & Screw Co	29
Cleveland City Forge & Iron Co	1
Cleveland Crane & Car Co	31
†Cleveland Facing Mill Co	—
Clinton Iron & Steel Co	30
Clow & Sons, James B	2
Cole, J. Wendell	48
Covert Mfg. Co	29
Cramp & Sons, Wm	25
Cremer & Bicknell	32
Crescent Steel Co	35
Danielson Machine & Tool Co	48
Davis Machine Co., W. P	29
Denison, Prior & Co	24
Delano, E. A	47
Detroit & Cleveland Navigation Co	38
Dixon Jos., Crucible Co	32
*Dodge Mfg Co	27
Dover Fire Brick Co	33
Drake, Bartow & Co	30
Emmerton, F. A	2
Enterprise Boiler Co	1
Erikson, Edward E	24
Excelsior Iron Works Co	41
Fitzsimons & Co	35
*Fix Sons	28
Forster, Waterbury & Co	1
Forsythe Pattern Works	35
Fraser & Chalmers	25
Frick Coke Co., H. C	1
Gandy Belting Co	48
Garden City Sand Co	33
Gerlach, Peter & Co	35
Ginther, G. H	36
Gobeille Pattern Co	35
Goodyear, S. W	29
Grasselli Chemical Co	40
Greenwald Co., I. & H	31
Hall Steam Pump Co	34
Hanna & Co., M. A	30
Harrison Safety Boiler Works	31
Hartford Steam Boiler Insp. & Ins. Co	25
Hendrick Mfg. Co., The	32
Heyl & Patterson	34
†Hickman, Williams & Co	—
Hiertz & Son, Theo	2
Hirsch, L. K	2
Holmes, Strachan & Co	33
Hooven, Owens & Rentschler Co	28
Hunt Robt. W., & Co	2
Hyde Bros. & Co	40
Illinois Central R. R	40
Ingersoll-Sergeant Drill Co	2
Iron Clad Paint Co	42
Ironsides Co	23
Jeffrey Mfg. Co	31
Jenkins Bros	32
Jones & Co., John T	2
Jones Foundry & Machine Co., W. A	1
Jones & Laughlins, Ltd	39
Kennedy, Walter	32
Kentucky Fire Brick Works	24
Konigslow & Bro., E	29
La Belle Steel Co	35
Lake Superior Consolidated Iron Mines	30
Laughlin & Co., Alex	32
Lidgerwood Mfg Co	31
Link-Belt Machinery Co	31
Lorain Foundry Co	47
Lorain Steel Co	39
Macbeth & Co	24
Magnolia Metal Co	2
Mason, Samuel R	29
Main Belting Co	32
Manning, Maxwell & Moore	26
Marion Steam Shovel Co	48
McKeefrey & Co	30
Meehan Boiler & Construction Co	48
Merchant & Co	41
Miller & Hays	25
Millett Core Oven Co	3-33
Moffat & Co., Geo. D	25
Monongahela Iron & Steel Co	35
Morris & Bailey Steel Co	35
National Engraving Co	34
National Steel Co	36
National Tube Co	36
†Newport Sand Bank Co	—
Northampton Emery Wheel Co	41
Northern Engineering Co	31
Norwood Bicycle Co., The	29
Nuttall Co. The R. D	28
Oak Hill Fire Brick & Coal Co	24
Oglebay, Norton & Co	30
†Ohio Sand Co	—
Otis Steel Co	23
†Parkhurst & Wilkinson Co	—
Perfect Lubricating Metal Co	48
Phillips' Sons Co., F. R	I-46
Phœnix Horse Shoe Co	24
Pickands, Mather & Co	30
Playford Stoker Co	31
Pollock, The Wm. B. Co	2
Prescott Steam Pump Co	34
Pressed Steel Car Co., The	38
Q & C Co	22
Rand Drill Co	2
Reading Crane & Hoist Works	33
Republic Iron & Steel Co	33
Riter-Conley Mfg. Co	33
Riverside Foundry Co	21
Rogers, Brown & Co	I-22
*Rockwell & Co., W. S	I—
Ryan, J. J. & Co	35
Scaife & Sons, Wm. B	47
Schaefer & Co., W. J	48
Scioto Star Fire Brick Works	33
Seaman, Sleeth Co	46
Sennett Co., Geo. B	42
‖Sharon Fire Brick Works	1
Shiffler Bridge Co	32
Skinner Chuck Co	29
Smith & Co. A. F	31
Southwark Foundry and Machine Co	42
Spearman Iron Co	48
Star Corundum Wheel Co	33
Stevens, F B	48
Stroud & Co., E. H	2
Struthers Iron & Steel Co	I-30
*Superior Charcoal Iron Co	27
Swarts Metal Refining Co	1
Tabor Mfg Co	33
Taylor's Sons Co., Chas	24
Textor, O	2
Tod Wm. & Co	42
Totten & Hogg Iron & Steel Foundry Co	46
Trethewey & Co., Ltd., Samuel	35
Union Mining Co	23
Union Boiler Tube Cleaner Co	1
Union Foundry & Machine Co	40
Universal Construction Co	40
Upson Nut Co	1
Van Dorn & Dutton Co	28
Vermillion Pine & Iron Land Co	48
Vulcan Mfg. Co	32
Washington Coal and Coke Co	34
Webster, Camp & Lane Machine Co	24
Webster Fire Brick Co	1
Wellman-Seaver Engineering Co	32
†We Fu Go Co	—
Wheeling Mold & Foundry Co	48
White, Byron H	35
Whiting Foundry Equipment Co	33
Wyman & Gordon	47

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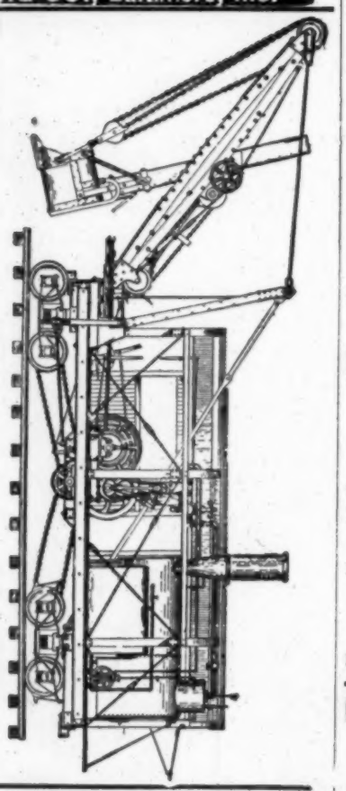

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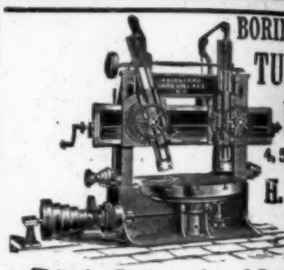

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